$5.00

CONSTRUCTION MANUAL
for the
KENTUCKY PORTABRAILLE
and the
KENTUCKY POCKETBRAILLE

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August, 1985

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PART ONE: THE KENTUCKY PORTABRAILLE

INTRODUCTION

This part of the manual provides complete instructions on how to build a Kentucky PortaBraille. It does not contain user operating procedures which may be found in the Kentucky PortaBraille/PocketBraille Users Guide.

The PortaBraille is an intelligent communication device for the blind and deaf-blind. It can send and receive ASCII data using a built-in 20-cell refreshable braille display and seven-key braille keyboard. It can also be used as a note-taking device by typing directly into its 56K memory. The PortaBraille is both battery and AC powered and very portable. It weighs under four pounds and measures approximately 8" x 6" x 2 1/2". With a full battery charge the unit can operate under heavy continuous use for at least ten hours. Under typical usage, a full charge will last for days or even weeks. Power consumption is only significant while the braille display is actually changing. The batteries are automatically recharged whenever the AC line cord is plugged in. The batteries and charger are built into the PortaBraille. The only external part is the detachable AC line cord.

Other built-in features include 8K, 32K, or 56K of RAM; 8K, 16K, or 32K EPROM; Centronics compatible parallel input or output; RS232C serial input/output; 7-key braille keyboard; settable baud rates and other communication parameters; upper case, lower case, and control character display capability; generation of all 128 ASCII characters; full or half-duplex operation; columnar data display mode; self-test mode; and many other operational features we are constantly adding to the PortaBraille's firmware.

The major design objective of this project was low cost. There is no shortage of high technology devices available for the blind that are too expensive for individual ownership. The total parts cost for the PortaBraille is about $800. It can be constructed in about ten hours by anyone with only moderate experience in assembling printed circuit boards. No special tools or knowledge is required. All printed circuit boards that go into the PortaBraille have been designed by the Kentucky Department for the Blind. As a convenience to builders and cost savings to users, all printed circuit boards are available at the manufacturer's cost as described in Appendix B. Also, we will place, at no charge, the latest firmware into an EPROM furnished by you.

If you have any questions or suggestions concerning the PortaBraille or this manual, please contact us at the address or phone number shown on the first page of this manual.

the larger piece of front panel into the front panel groove of the bottom cover with the cut edge into the groove with epoxy. Place the small piece of front panel into the groove of the front half of the top cover with the cut edge into the groove with epoxy. To be sure the front panel pieces will meet properly, temporarily place this smaller piece of the top cover (with its small piece of front panel) on top of the bottom cover. Let the two front panel pieces move out of their grooves slightly if necessary so that the factory edges meet all the way across. Make sure the front edges of side walls are flush with each other. Let the epoxy cure in this position. Be sure that no epoxy from the top cover meets the bottom cover.

6) After the epoxy has cured, lift up the front half of the top cover to make sure it is not stuck to the bottom cover. Then, replace it and position the rear half of the top cover on the bottom cover. Make sure the front and rear edges of the side walls are flush with the bottom cover. There will be a gap between the two halves of the top cover equal to the width of the saw blade used earlier to cut them. While keeping them in this position, carefully center a 12" x 1" piece of filament tape across the gap on top of the case and down each side. This will be the hinge for the front of the top cover. Use a single-edged razor blade to slit the tape at the gaps on each side and to trim the ends of the tape straight across at the molded rib on each side of the case. The front of the top cover should now flip back (which will later expose the braille display and keyboard).

7) Stick the self-adhesive rubber feet supplied with the case to the bottom surface of the bottom cover near each of the four corners. Be careful not to place them too close to any of the holes you drilled so as to interfere with a screw head.

8) The inside surfaces of the bottom cover and rear piece of the top cover have little round molded standoffs protruding about 1/8" up from the plastic surface. These were intended as circuit board mounting post but they actually interfere with the circuit boards and display on this project. Break all six of them off by grasping them tightly with vise-grips or pliers and twisting until they break off. The two near the front of the bottom cover must additionally be shaved with a single-edged razor blade until completely flush with the surrounding surface. Be careful and don't cut yourself. (The two molded standoffs on the inside surface of the front half of the top cover do not have to be removed at all.)

"MICROPROCESSOR BOARD FOR THE KENTUCKY PORTABRAILLE
AND THE KENTUCKY POCKETBRAILLE"
(and Optional Expansion Memory Board)

General Description

This pc board and circuit was designed by the Kentucky Department for the Blind for use in the Kentucky PortaBraille. It is a CMOS Z80 based design with on-board firmware to control all functions of the PortaBraille or PocketBraille. The circuit is implemented entirely with high speed CMOS technology to permit battery operation. Features include 8K, 32K, or 56K of RAM; 8K, 16K, or 32K EPROM; RS232C I/O connector; parallel centronics compatible input or output connector; 7-key braille keyboard; and an output connector designed to connect directly to the Kentucky Driver Board for the Tiflotel Braille Display. Many parameters and modes of operation may be selected by the user through commands entered on the braille keyboard. Operating procedures are covered in the Kentucky PortaBraille/PocketBraille Users Guide.

Board Assembly

This microprocessor board is easy to assemble. When complete, it mounts inside the PortaBraille or PocketBraille case. Perform the following steps to assemble the board:

1) Inspect the pc board carefully for any obvious flaws. It is much easier to spot an imperfection in a trace now than later when all the parts are mounted. All the following parts are mounted on the component side, that is, the side that has the printed component designations. Reference the drawings in Appendix A throughout the following steps.

2) Solder low profile sockets in the indicated positions for all integrated circuits U1 thru U11. If pin 1 is indicated on the sockets, be sure to orient them correctly as shown on the board surface and attached drawings.

3) Memory configuration straps A through Q are provided so that the entire 64K address space of the Z80 can be utilized efficiently in a variety of RAM to ROM ratios. Socket U4 may contain an 8K, 16K, or 32K CMOS EPROM (using 27C64, 27C128, or 27C256 respectively). At the time of this writing, firmware is being supplied in 8K EPROMS. Likewise, socket U5 may contain an 8K or 32K CMOS RAM (HM6264LP-15 or HM62256LP-15), or, it can be used as the connector to a piggybacked expansion memory board containing 56K of CMOS RAM. After deciding upon the EPROM and RAM size you will use, install the straps as shown in the table on the microprocessor board layout drawing. Of course, these straps may be changed in the future if necessary to accommodate a different configuration.

11) Insert but do not yet solder connectors J1 and J2. Install the four #4 x 40 x 3/8" screws up through the pc board and then through the connector mounting holes on J1 and J2. The screws will self-thread into J1. However, two #4 x 40 nuts must be installed on J2. Make sure the two connectors' rear panel mounting surfaces are straight and flush with each other before tightening. Solder all connections.

    If your cabinet back panel does not yet have the holes made as shown in the drawings, then you will have to postpone the rest of this step until the back panel is prepared. Also, if you are building a PocketBraille omit the rest of this step. Otherwise, mount the back panel to the microprocessor board by inserting J1 and J2 through their respective holes and tightening down with four #4 x 40 x 3/8" screws inserted from the outside of the back panel in toward the connectors. J1's holes are threaded and require no nuts. J2, however, will require two #4 x 40 nuts. There is barely enough clearance on J2 to position these two nuts. In fact, you will have to turn the other two nuts on J2 such that a flat edge is parallel to the rear panel in order to gain enough clearance to position these two nuts. Even then they may have to be wedged firmly into position. Tighten all four screws securely.

12) Solder three 2", 20-gauge, stranded, insulated wires to the three pads at J4 (soldered on the back side and extending 2" upward on the component side). On the ends of these three wires, solder miniature male nylon connector pins (miniature molex). Insert the male pins into a three-pin female miniature nylon connector; V+ to pin 1, GND to pin 2, and V- to pin 3. Twist the connector a few times to group the three wires together. This forms the power input cable and will later connect to a male 3-pin connector (with female pins) coming from the power board (or 9V batteries if you are building a PocketBraille).

13) Install and solder keyswitches Key 1 through Key 6 and Key SP as shown. Key SP is the space key and is wider than the other six. Due to the mounting pins on the keyswitches, they can only be inserted one way. Make sure each key is firmly against the board surface before soldering the pins.

    If you are building a PocketBraille, you may prefer the keys to be mounted higher (flush with the inside top cover). If so, insert and solder the 28 lead sockets specified in the parts list, 4 per keyswitch at each switch location. Then mount and solder the

"BRAILLE DISPLAY DRIVER BOARD FOR THE KENTUCKY PORTABRAILLE"

General Description

This pc board and circuit was designed by the Kentucky Department for the Blind for use in the Kentucky PortaBraille. It contains all the electronics required to actuate the Tiflotel 20-cell braille display Model 51.820.M6 and is a completely solid state, low power design.

The two later sections on hardware and software interfacing are detailed explanations of the protocol and interfacing of this driver board directly to a host system other than the PortaBraille. If your host system is the PortaBraille, then this board will simply plug into the PortaBraille's microprocessor board and it is not necessary to read or understand the information in those two sections. The Kentucky PortaBraille has been designed to interface directly with this driver board.

Board Assembly

This driver board is easy to assemble. When complete, it simply plugs onto the back of the Tiflotel braille display creating a compact, one-piece unit only slightly larger than the Tiflotel braille display alone. Perform the following steps to assemble the board:

1) Inspect the pc board carefully for any obvious flaws.

2) Solder low profile sockets on the component side of the board for integrated circuits U1 through U29 in the locations indicated. If pin one is indicated on the sockets, be sure to orient them correctly as shown on the board surface and attached drawings. All IC's are not oriented alike.

3) Solder the following discrete parts on the component side as indicated: resistors, capacitors, transistors, diodes, and voltage regulator. Observe proper polarity and orientation on some of these parts. Note that the diodes are easily damaged by excessive heat from a soldering iron. Test all six diodes with a VOM both before and after installation. A shorted diode will damage other components when power is applied.

4) Solder an insulated jumper wire on the component side between pads marked A and B.

5) Place J3 at the proper location on the component side and solder to pads located on the non-component side just as you did the IC sockets. Note that the solder tail pins on J3 are the short pins; the side with the longest pins should point up and will later

8) Plug the entire board assembly onto the back of the braille display, making sure that J1 and J2 are mating correctly to the Tiflotel's connectors. Also, make sure the legend marked "UP" is the edge near the braille cells or top of the display. Secure the Kentucky driver board to the threaded spacers mounted on the Tiflotel unit with two #4 x 40 x 3/8" screws. There should be a resulting clearance of about 1/16" between the tips of the socket solder tails and the back surface of the Tiflotel unit.

9) The driver board is now complete and ready for use. It has essentially become an integral part of the Tiflotel display suitable for interfacing to the Kentucky PortaBraille or any other host computer system as described in the next two sections. (Again, if you are using this driver board as part of a Kentucky PortaBraille, then it is not necessary to read or understand these next two sections).

Software Interfacing

There are two basic operations performed by the driver board; write to a cell and erase a cell. Any one of the twenty cells may be erased or written at any time. Only one cell may be changed at a time and a cell must first be erased before it is written. The driver board appears as one 8-bit data output port address to the host and all data bytes sent to the driver board must have the following format:

Cell Address or Pin Data - D0 through D5

Mode Bits - D7, D6
- 00 = Select Cell
- 01 = Write Cell
- 10 = Select and Erase Cell
- 11 = Not Used

To erase a cell, the host must send two bytes to the driver board. The first byte must have bit 7 high, bit 6 low, and bits 0 through 5 must contain the cell address in binary from one to twenty. This will cause erase power to be applied to the selected cell. After an 11 msec delay, the host must send a zero byte (all bits low) to the driver board to remove erase power and de-select the cell. A delay of at least 14 msec is then required before a new sequence may begin.

To write a new dot pattern to a cell the host must send four bytes to the driver board and the cell must have been previously erased.

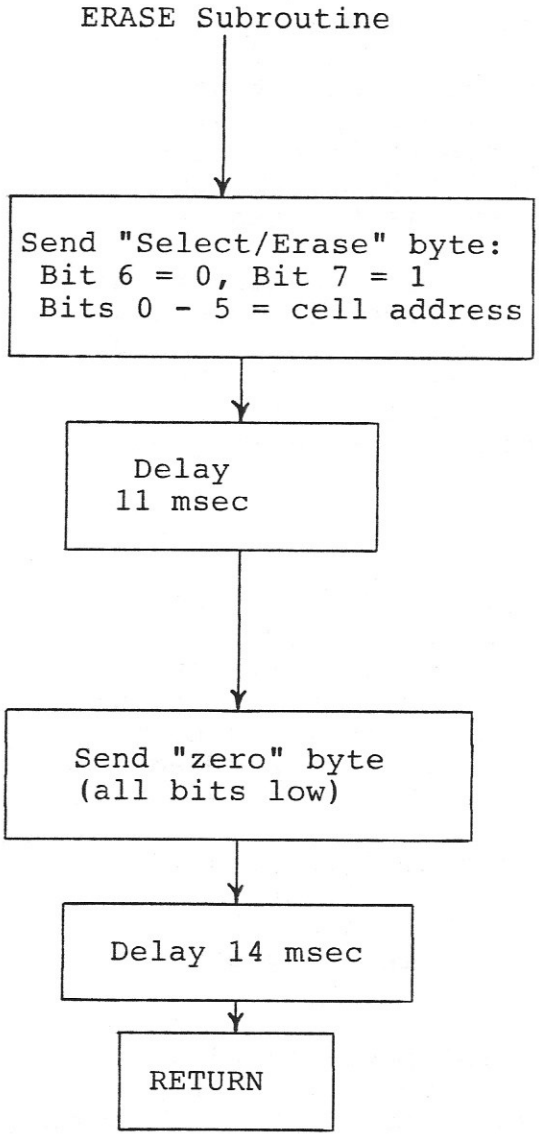
The first byte selects a cell for writing. Bits 6 and 7 must be low and bits 0 through 5 must contain the cell address in binary from one to twenty.

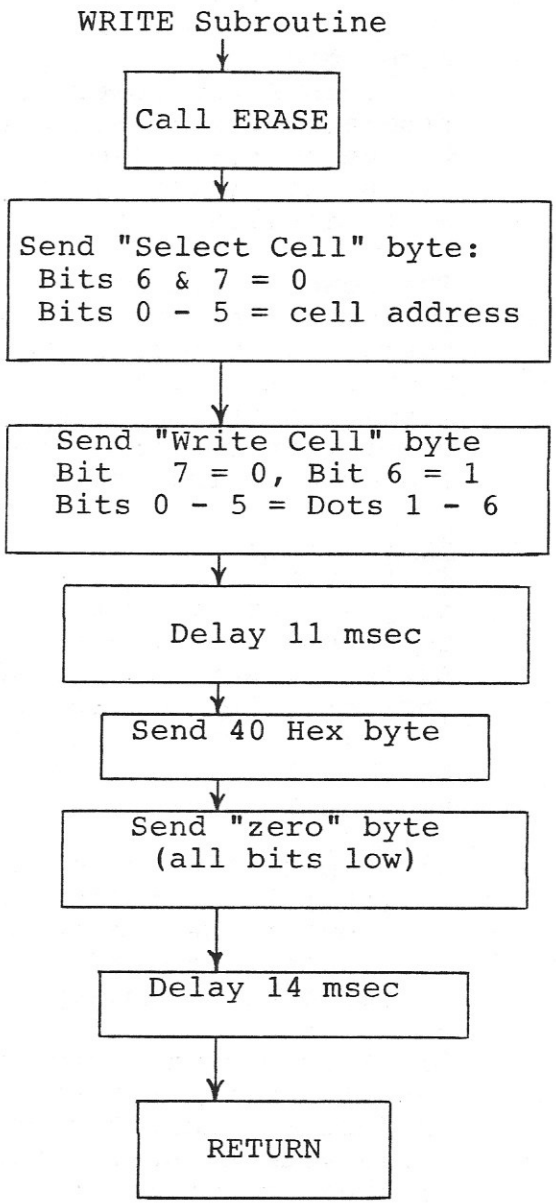
The second byte contains the pin data and may immediately follow the first byte. Bit 7 must be low, bit six must be high, and bits 0 through 5 contain the pin data corresponding to dots 1 through 6 respectively. A high bit means raise the dot, a low bit means leave the dot lowered. This byte causes write power to be applied to the desired dots of the selected cell. The host must now delay for 11 msec.

The third byte must be sent after the 11 msec delay described above and serves to remove write power from the pins. This byte should have only bit 6 high, that is, a value of 40 hex.

The fourth and final byte may immediately follow the third byte described above. It de-selects the cell and returns the display and driver circuit to a low power, stand-by condition. This must be a zero byte (all bits low) and a delay of at least 14 msec is required after this byte is sent before a new sequence may begin.

SOFTWARE DRIVERS FOR THE KENTUCKY DRIVER BOARD
FOR THE TIFLOTEL BRAILLE DISPLAY MODEL 51.820.M6




WRITE Subroutine
Call ERASE
Send "Select Cell" byte:
Bits 6 & 7 = 0
Bits 0 - 5 = cell address
Send "Write Cell" byte
Bit 7 = 0, Bit 6 = 1
Bits 0 - 5 = Dots 1 - 6
Delay 11 msec
Send 40 Hex byte
Send "zero" byte
(all bits low)
Delay 14 msec
RETURN

nearest the front edge of the board. The two middle leads are the AC inputs. Solder as indicated diodes CR1 and CR2.

5) Solder capacitors C1 and C2 in place observing proper polarity. Place a length of insulation ("spaghetti") over the rear leads of each capacitor to prevent them from touching the battery pack later. Solder switch S1 into place.

6) Install and solder transformer T1. Make sure it is oriented correctly by observing the terminal numbers and that it is seated firmly down against the board surface before soldering.

7) The two-prong AC input jack J1 is made from two male two-prong connectors compatible with the standard television "cheater" cords. The intention is to make a right angle, pc mount jack out of these two connectors. First, saw off the mounting plate at each end of both connectors such that the resulting pieces are about .6" wide. Insert the rear of the pins of one of these units down through the two holes marked "AC INPUT" such that the two pluggable prongs are pointing upward. While keeping the two pins vertical, solder the rear of the connector to the pads on the bottom of the pc board. Position the other connector on top of the board at right angles to the one just installed and with the pluggable prongs pointing toward the rear of the board. Solder each tailpiece of this second connector to the corresponding vertical pins of the other connector making sure that the bakelite is perfectly vertical and firmly against the board surface. Cut off the protruding tailpieces of the first connector on the non-component side of the board. Next, liberally apply epoxy at all areas where the bakelite pieces touch the pc board surface or each other. This epoxy is absolutely essential if the connector is to withstand repeated plugging and unplugging of the AC line cord. Set the board on a level surface and let the epoxy cure.

8) Fabricate the battery pack as follows: Begin with 24 AA Nicad fast charge cells with solder tabs. Place two sheets of paper on a flat surface (to protect the surface from excess epoxy later). Lay 12 batteries side by side (not end to end) on each paper and place a heavy object at the end of each group to hold the batteries firmly next to each other. The leftmost battery in each group should have its positive terminal pointing away from you. Then, each battery, as you progress to your right, should be oriented opposite the previous one ending with the twelfth battery facing the opposite direction as the first (see drawings). The batteries within each

the area indicated with the plus and minus output terminals at the front right corner. Be sure the battery terminals do not contact the nearby leads of C1 and C2. Secure the battery pack to the pc board with 10" cable ties. Two cable ties pass over the batteries about 1/3 of the way from each end. They should go through the holes in the board passing under the board and over the batteries. Draw the batteries tightly against the board before cutting off the excess cable tie length and make sure the fastening end of the cable tie is just above the center board holes. Likewise, hook two 10" cable ties together and position across the batteries from left to right passing through the holes and under the board and over the batteries. Again, draw down tight and make sure the fastening ends are just above the board holes. There will not be sufficient clearance later if the fastening ends are under the pc board or on top of the battery pack.

Finally, connect the battery pack to the three wires previously connected to the pads marked "BATT." on the board. From this point on, handle the board with battery pack carefully since DC voltages will be exposed on the rear side of the board. Do not lay the board on any conducting surfaces! Do not wear rings or other jewelry while handling the board. Turn the battery switch off (push toward the right). Route and solder the insulated wire from the "C" pad at the "BATT." location to the COMMON battery terminal (front left corner of both layers). Solder the short insulated wire from the "+" pad at "BATT." to the battery pack positive output (front right corner of the top layer). Likewise, solder the short insulated wire from the "-" pad at "BATT." to the battery pack negative output (front right corner of the bottom layer). Again, keep the board away from conducting surfaces from this point on! The battery pack is now completely installed and connected to the power board.

9) Next install the output cable on the power board. Use three 3", 20-gauge, stranded, insulated wires, each terminated on miniature female pins and inserted into a 3-pin male miniature nylon (molex) connector. Solder the loose wire ends to the power board at the location marked "OUTPUT." Connector position 1 goes to the "+16V" pad on the board; position 2 to the pad marked "GND"; and position 3 to the "-16V" pad. Carefully twist the connector a few times to group the wires together and route them clockwise around S1 and toward the right rear corner of the power board. This cable will later mate with one from the microprocessor board.

"FINAL ASSEMBLY AND TESTING OF THE KENTUCKY PORTABRAILLE"

Complete all the previous sections of Part One of this construction manual before beginning this section. Follow the steps below to complete the assembly of a working PortaBraille.

1) Mount the assembled power board inside the bottom cover by lowering the board's four mounting holes over the vertically protruding screws previously secured to the bottom cover. Place a # 6 x 32 nut and internal tooth lockwasher on each of the rear screws but do not tighten. On each of the front screws place "two" # 6 x 32 nuts followed by a # 6 x 32 x 1" hex threaded spacer. Install both front left nuts loosely before tightening any nuts. You may have to temporarily flex the bottom cover a bit in order to obtain enough clearance between the front left screw and the transformer to get the nuts threaded past the transformer.

   Finally, tighten all nuts and thread on and tighten the 1" spacers on the two front screws. These 1" spacers will provide a mounting point for the microprocessor board later.

2) Mount the Tiflotel 20-character braille display with the attached and assembled Kentucy Driver Board to the inside front of the bottom cover. Secure it by passing four 3mm x 10mm screws from the outside of the bottom cover, through the cover, and into the threaded holes in the bottom of the Tiflotel display (note that these are 3mm metric threads). Be sure the Kentucky Driver Board is facing the rear of the PortaBraille. Tighten down the display securely. Attach the 16-conductor ribbon cable with socket connectors to J3 on the driver board. Make sure the connector mates properly with J3 and that the ribbon cable, when plugged in, extends downward (not upward!) from J3. Crease the cable 90 degrees after it leaves J3 such that it passes between C1 and C2 on the power board. At a distance of two inches from the driver board fold the ribbon cable to the right 90 degrees. This will place it in position for connection to the microprocessor board next.

3) Mount the assembled microprocessor board over the power board. As you lower the microprocessor board into position, be sure the attached rear panel slides into the rear side grooves made for it. When it is nearly seated, connect the free end of the ribbon cable from J3 on the driver board to J3 on the microprocessor board. Be sure that when inserted the ribbon cable extends downward from the microprocessor board and that it is not pinched or otherwise obstructed along its path to the

8) Pin 1 of U6 on the driver board should show a train of pulses lasting for about 1/2 second after power on. Likewise, at U8, pin 8 on the driver board. If so, check Q2.

9) Call us. We will be glad to help if we can.

5) Turn the power switch off. Hold down key 2 while turning the power switch back on. Release key 2. The PortaBraille should now be in a self-test mode. The display will change every 4 seconds until you terminate the self-test by turning the unit off. This is a good time to verify that all dots are working. The self-test mode repeatedly displays five different patterns, each for three seconds. First, all dots 1 and 4 are raised. Next, dots 2 and 5; then dots 3 and 6; then all dots; then no dots. The pattern repeats indefinitely. The delay between lines gives you an opportunity to inspect the display for missing or stuck dots. Note that if your finger is touching a cell when it tries to change, the dot pattern may not come up correctly (but you will not damage the display by doing this). Repeat this step after removing the AC line cord and turning on the battery switch. Things may or may not work well depending on the charged state of the battery pack.

6) When you are tired of performing the self test, turn the PortaBraille power switch off and unplug the AC line cord. Install the top cover by lowering it onto the unit and guiding the rear panel into the grooves made for it. The sides should fit together snugly since they have a molded tongue and groove design. While holding the top and bottom covers together, insert and lightly tighten from the bottom cover the two screws furnished with the case. The PortaBraille is now finished. Flip the top front cover back to expose the keyboard and power switch.

7) Reference the Kentucky PortaBraille/PocketBraille Users Guide for various commands you will want to try on the PortaBraille. At the first opportunity, recharge the batteries by leaving the AC line cord plugged in for 8 hours and the battery switch on, (the power-on switch on the microprocessor board does not have to be on to recharge the batteries). See Appendix D or the Users Guide for recommended practices to insure maximum battery life and efficiency.

8) Lastly, and most importantly for the benefit of other users, please forward to us any suggestions you may have to improve this construction manual or the PortaBraille. We welcome constructive criticism and firmly believe that input from many different builders and users is a key ingredient to a successful project.

simply as a convenience to builders and usually represents the vendors we have used. If you substitute manufacturers for a part specified, make sure the alternate part is equivalent both electrically and mechanically. Otherwise, it may not work properly or fit properly into the case.

fastened into the case in the previous step. Tighten down the board to the case securely with four #4 x 40 nuts. You may have to carefully tighten the nuts with needle nose pliers since there is probably too little clearance to use a nut driver. Be careful to not damage one of the keyswitches.

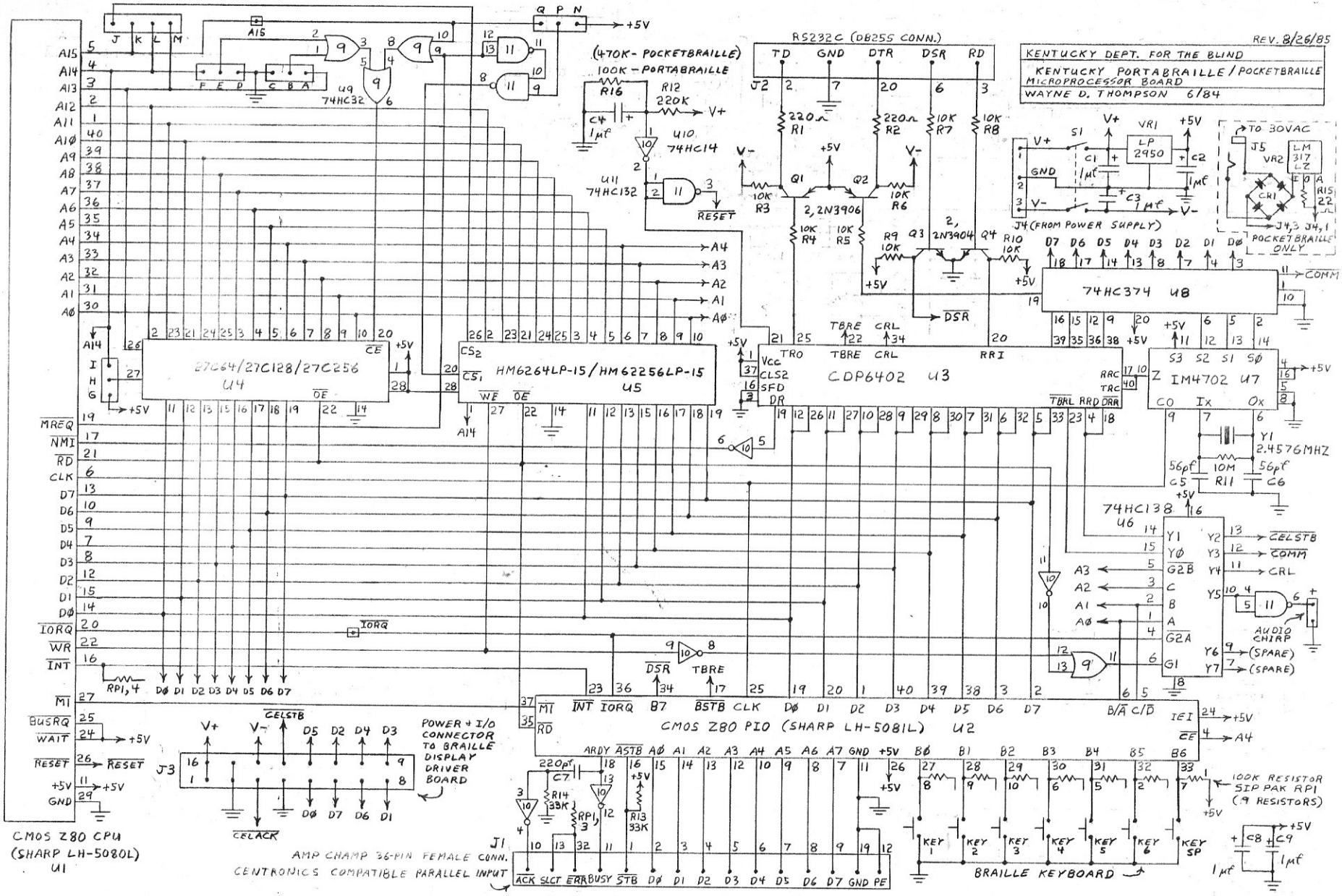
6) Swing the hinged rear edge of the case up vertically against J1 and J2. Check hole alignment and connector clearance. There should be enough clearance all the way around each connector to allow the plugging in of its mating connector. Some additional filing or cutting may be necessary if the case holes do not line up exactly with J1, J2, and J5. When all holes properly align, insert four #4 x 40 x 3/8" machine screws from the outside rear edge of the case and into J1 and J2. J1's holes are threaded and require no nuts. J2, however, will require two #4 x 40 nuts. There is barely enough clearance on J2 to position these two nuts. In fact, you will have to turn the other two nuts on J2 such that a flat edge is parallel to the rear case surface in order to gain enough clearance to position these two nuts. Even then they may have to be wedged firmly into position. Tighten all four screws securely.

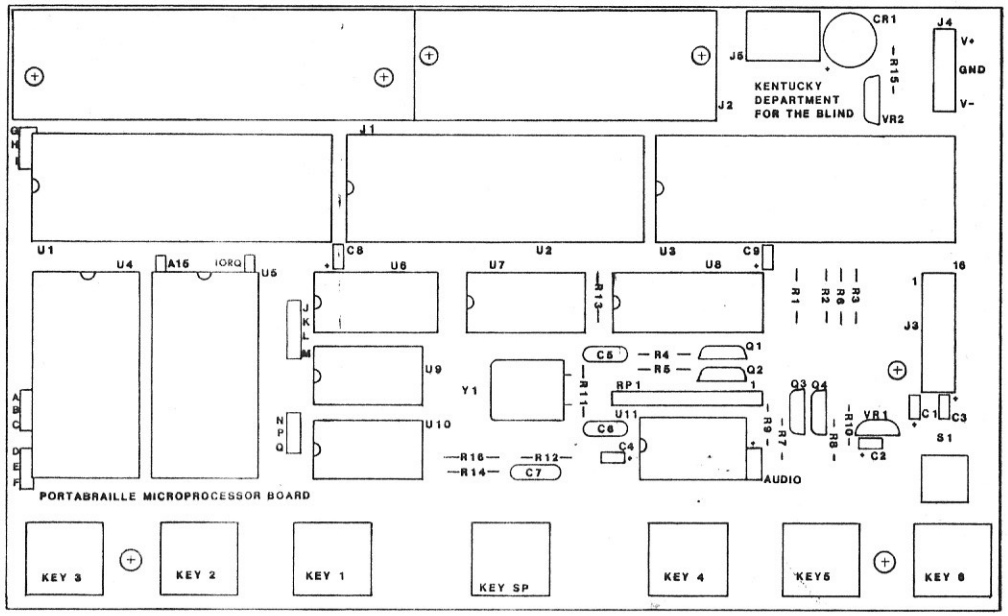
7) Tape two 9V nicad batteries together end to end with the bottoms of the batteries together. Snap a 9V battery connector clip on each battery. Route and tape down the wires from one battery along the wide side of the combined pack toward the other end. Cut all wires off about 2" beyond this end. Strip the ends and twist together the positive lead from one battery with the negative lead from the other battery. This will be the ground connection. The remaining positive lead will be V+ connection and the remaining negative lead will be the V- connection. Solder one miniature female molex pin on each of the three leads. Insert these pins into a male miniature molex connector. V+ goes to connector position 1; ground to position 2; and V- to position 3. Twist the finished assembly a few times to group the wires. This power connector will mate with the female power connector on the microprocessor board in the next step.

8) Take a 3 1/2" x 1" wide piece of filament tape and fold it lengthwise back on itself creating a strip that is sticky on both sides. Press this onto the inside bottom surface of the case just to the right of the pc board. Then, press the battery assembly onto the exposed sticky portion of tape to secure it into the case. Be sure that the battery pack is resting on its narrow side, the connector is toward

APPENDIX A: Drawings and Schematics

This appendix contains all the schematics, pc board layout drawings, case detail drawings, and photos for the Kentucky PortaBraille and the Kentucky PocketBraille. Reference is made to these drawings throughout the construction manual. Exact part specifications can be found by referencing the schematic designation on these drawings to the parts list in Appendix B.


KENTUCKY DEPT. FOR THE BLIND
KENTUCKY PORTABRAILLE / POCKETBRAILLE MICROPROCESSOR BOARD
WAYNE D. THOMPSON 6/84
REV. 8/26/85
RS232C (DB25S CONN.)
TD GND DTR DSR RD
J2
(470K - POCKETBRAILLE)
100K - PORTABRAILLE
R16
R12 220K
C4 1μf
U10 74HC14
U11 74HC132
RESET
220Ω R1
220Ω R2
10K R7
10K R8
10K R3
10K R6
2, 2N3906
2, 2N3904
10K R4
10K R5
R9 10K
R10 10K
Q1 Q2 Q3 Q4
DSR
J4 (FROM POWER SUPPLY)
S1
VR1 LP 2950
C1 1μf
C2 1μf
C3 1μf
TO 30VAC
J5
VR2 LM 317 LZ
CR1
R15 22
J4,3 J4,1
POCKETBRAILLE ONLY
74HC374 U8
D7 D6 D5 D4 D3 D2 D1 D0
COMM
U9 74HC32
A15 A14 A13 A12 A11 A10 A9 A8 A7 A6 A5 A4 A3 A2 A1 A0
J K L M
F E D C B A
Q P N
+5V
27C64/27C128/27C256 U4
HM6264LP-15/HM62256LP-15 U5
CDP6402 U3
TRO TBRE CRL RRI
TBRE CRL
IM4702 U7
S3 S2 S1 S0
CO Ix Ox
Y1 2.4576MHZ
56pf C5
10M R11
56pf C6
74HC138 U6
Y1 Y0 G2B C B A G2A G1
Y2 CELSTB
Y3 COMM
Y4 CRL
Y5
Y6 (SPARE)
Y7 (SPARE)
AUDIO CHIRP
MREQ NMI RD CLK D7 D6 D5 D4 D3 D2 D1 D0 IORQ WR INT
RP1,4
M1 BUSRQ WAIT RESET +5V GND
CMOS Z80 CPU (SHARP LH-5080L) U1
CMOS Z80 PIO (SHARP LH-5081L) U2
INT IORQ B7 BSTB CLK D0 D1 D2 D3 D4 D5 D6 D7
B/Ā C/D
IEI
ARDY ASTB A0 A1 A2 A3 A4 A5 A6 A7 GND +5V B0 B1 B2 B3 B4 B5 B6
220pf C7
R14 33K
RP1,3
R13 33K
100K RESISTOR SIP PAK RP1 (9 RESISTORS)
KEY 1 KEY 2 KEY 3 KEY 4 KEY 5 KEY 6 KEY SP
BRAILLE KEYBOARD
C8 1μf C9 1μf
J3
V+ V- CELSTB D5 D2 D4 D3
D0 D7 D6 D1
CELACK
POWER + I/O CONNECTOR TO BRAILLE DISPLAY DRIVER BOARD
J1
AMP CHAMP 36-PIN FEMALE CONN.
CENTRONICS COMPATIBLE PARALLEL INPUT
ACK SLCT ERR BUSY STB D0 D1 D2 D3 D4 D5 D6 D7 GND PE



BOARD LAYOUT

NOTES:

1) DEPENDING ON THE EPROM/RAM CONFIGURATION YOU USE, INSTALL STRAPS ACCORDING TO THE TABLE ABOVE.
2) J5, CR1, R15, AND VR2 ARE REQUIRED ONLY ON THE POCKETBRAILLE.
3) J3 IS REQUIRED ONLY ON THE PORTABRAILLE.
4) THE 56K EXPANSION RAM BOARD, IF USED, PLUGS INTO SOCKET U5.

MICROPROCESSOR BOARD
MEMORY CONFIGURATION
STRAPS REQUIRED

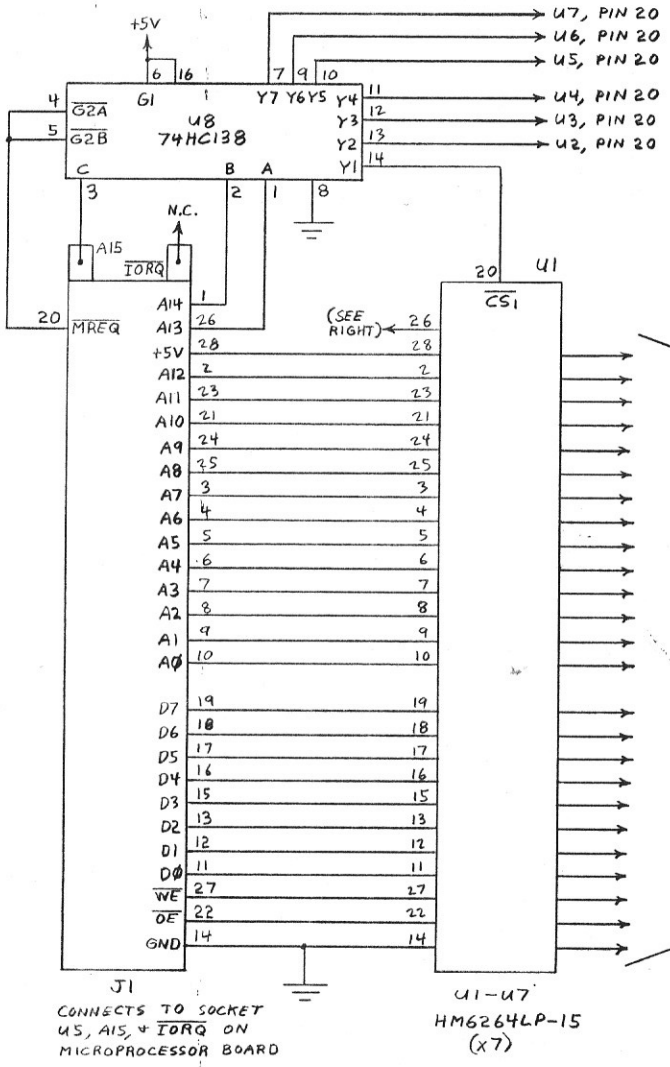
EPROM SIZE	RAM SIZE (5) 8K RAM CHIP	32K RAM CHIP (4)	56K EXP. RAM BOARD
8K	AB,EF,GH,JM,NP	BC,DE,GH,JM,PQ (1)	AB,EF,GH,JM,NP
16K	BC,EF,GH,JL,NP	BC,DE,GH,JM,PQ (1)	BC,EF,GH,JM,NP (2)
32K	BC,DE,HI,JK,NP	BC,DE,HI,JM,PQ	BC,DE,HI,JM,NP (3)

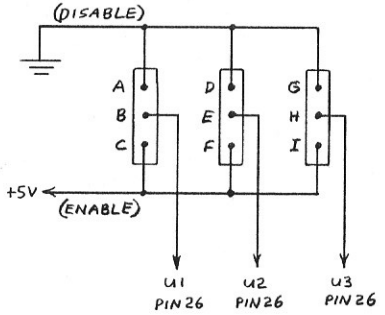
Notes:

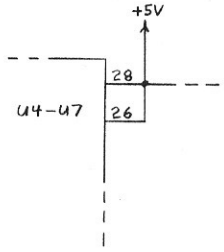
(1) When requesting firmware for these two options you must request the 32K version, even if burned into 8K or 16K EPROM.
(2) U1 on expansion memory board must be disabled (48K RAM remaining)
(3) U1,U2, and U3 on expansion memory board must be disabled (32K RAM remaining).
(4) 32K RAM chip (HM62256) not available until early 1986.
(5) If the 32K RAM chip is used, RAM starts at 8000H regardless of EPROM size. If the 8K RAM chip or 56K expansion RAM board is used, RAM starts at 2000H with an 8K EPROM, 4000H with a 16K EPROM, and 8000H with a 32K EPROM.

KENTUCKY DEPT. FOR THE BLIND
PC BOARD LAYOUT FOR THE KENTUCKY PORTABRAILLE AND POCKETBRAILLE MICROPROCESSOR BOARD
WAYNE D. THOMPSON 7/85

KENTUCKY DEPT. FOR THE BLIND
KENTUCKY PORTABRAILLE/POCKETBRAILLE EXPANSION MEMORY BOARD (56K)
WAYNE D. THOMPSON 7/85

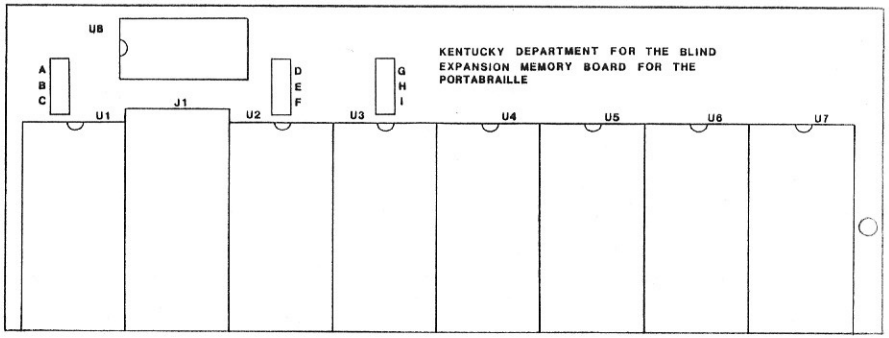




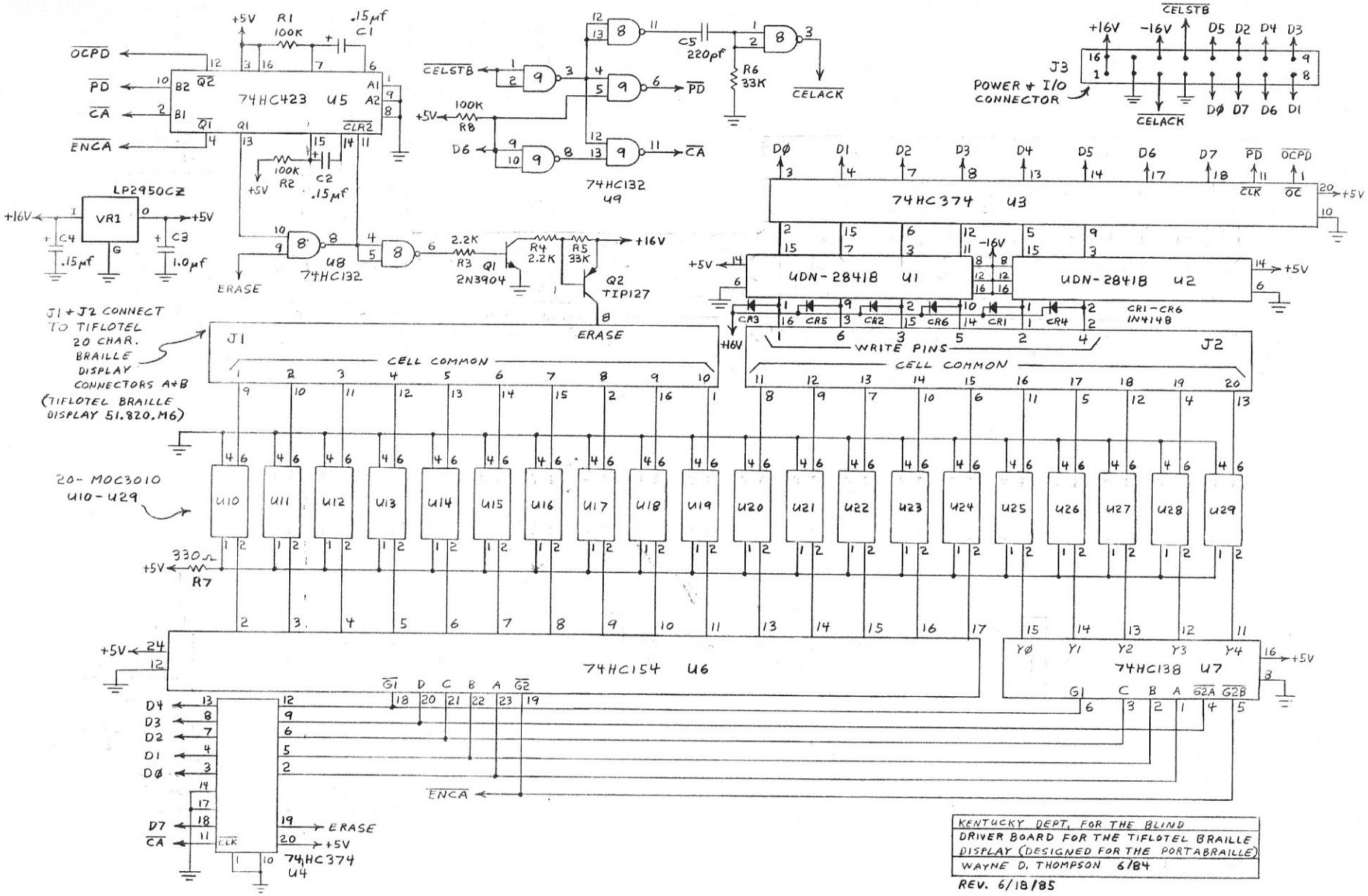


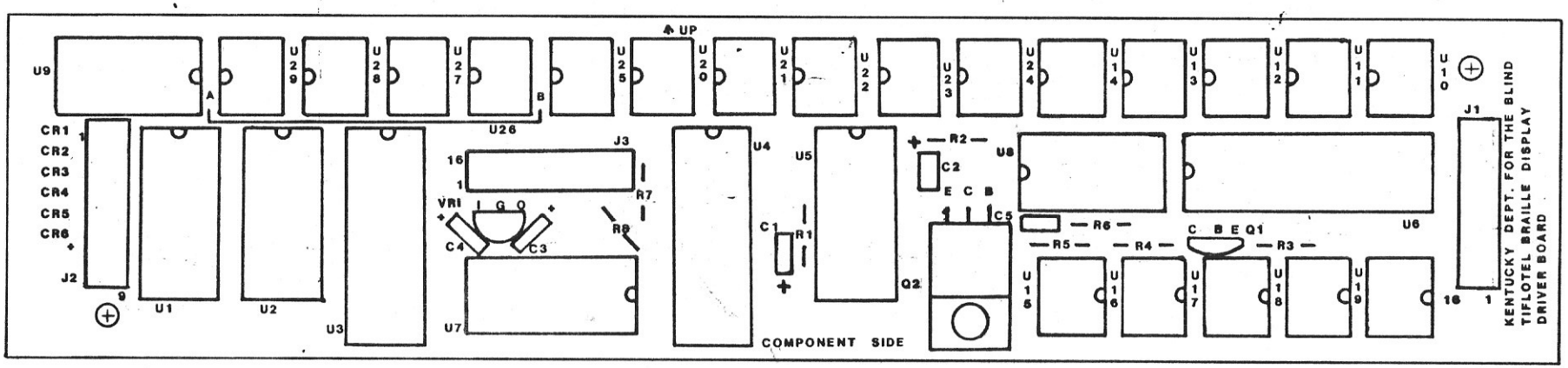
JUMPER NOTES:

1) FOR 8K EPROM, ENABLE U1, U2, + U3 (STRAPS BC, EF, HI)
2) FOR 16K EPROM, DISABLE U1 (STRAPS AB, EF, HI)
3) FOR 32K EPROM, DISABLE U1, U2, + U3 (STRAPS AB, DE, GH)



BOARD LAYOUT


74HC423 U5
74HC132 U9
74HC132 U8
LP2950CZ VR1
74HC374 U3
UDN-2841B U1
UDN-2841B U2
CR1-CR6 IN4148
WRITE PINS
J1
J2
CELL COMMON
J1 + J2 CONNECT TO TIFLOTEL 20 CHAR. BRAILLE DISPLAY CONNECTORS A+B
(TIFLOTEL BRAILLE DISPLAY 51.820.M6)
20- MOC3010 U10-U29
74HC154 U6
74HC138 U7
74HC374 U4
Q1 2N3904
Q2 TIP127
J3
POWER & I/O CONNECTOR
ERASE
ENCA
CELACK
CELSTB
OCPD
PD
CA
KENTUCKY DEPT. FOR THE BLIND
DRIVER BOARD FOR THE TIFLOTEL BRAILLE DISPLAY (DESIGNED FOR THE PORTABRAILLE)
WAYNE D. THOMPSON 6/84
REV. 6/18/85



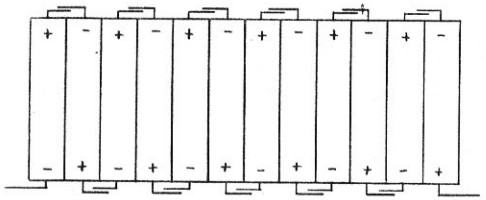
BOARD LAYOUT

NOTES:

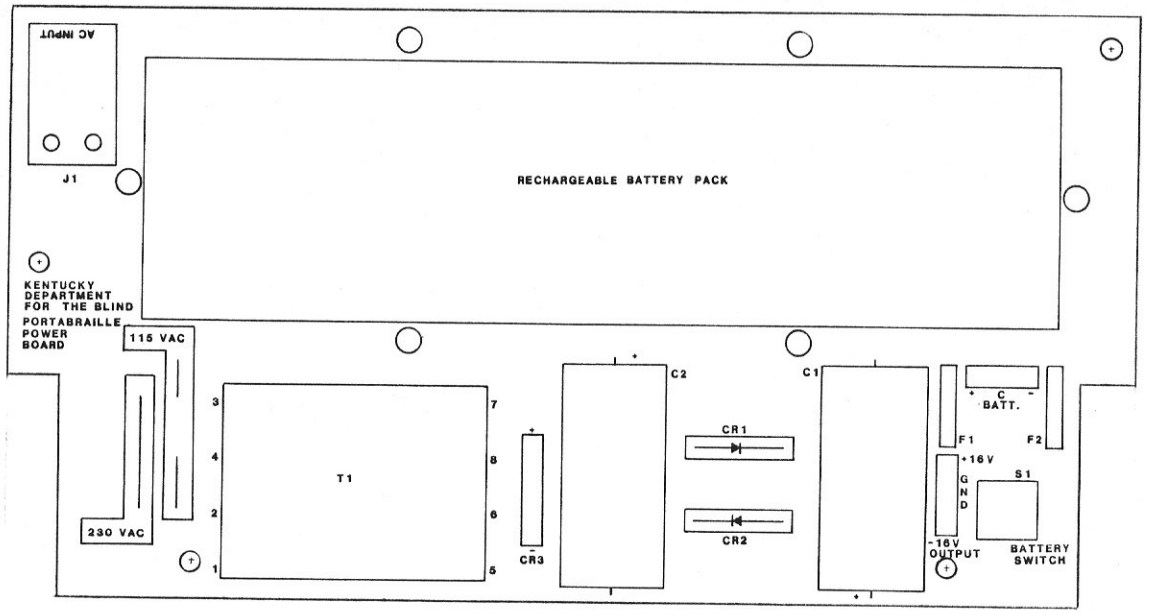
1) CONNECTORS J1 & J2 PLUG DIRECTLY ONTO THE TIFLOTEL DISPLAY CONNECTORS
2) PASS TWO SCREWS THROUGH THE HOLES ABOVE J1 AND BELOW J2 TO MOUNT THIS BOARD ON THE TIFLOTEL DISPLAY.
3) POWER AND I/O CONNECTIONS TO THE PORTABRAILLE MICROPROCESSOR BOARD (OR OTHER HOST SYSTEM) ARE MADE AT J3.
4) INSTALL JUMPER FROM PAD "A" TO PAD "B".

KENTUCKY DEPT. FOR THE BLIND
LAYOUT FOR DRIVER BOARD FOR THE TIFLOTEL BRAILLE DISPLAY
WAYNE D. THOMPSON 7/85

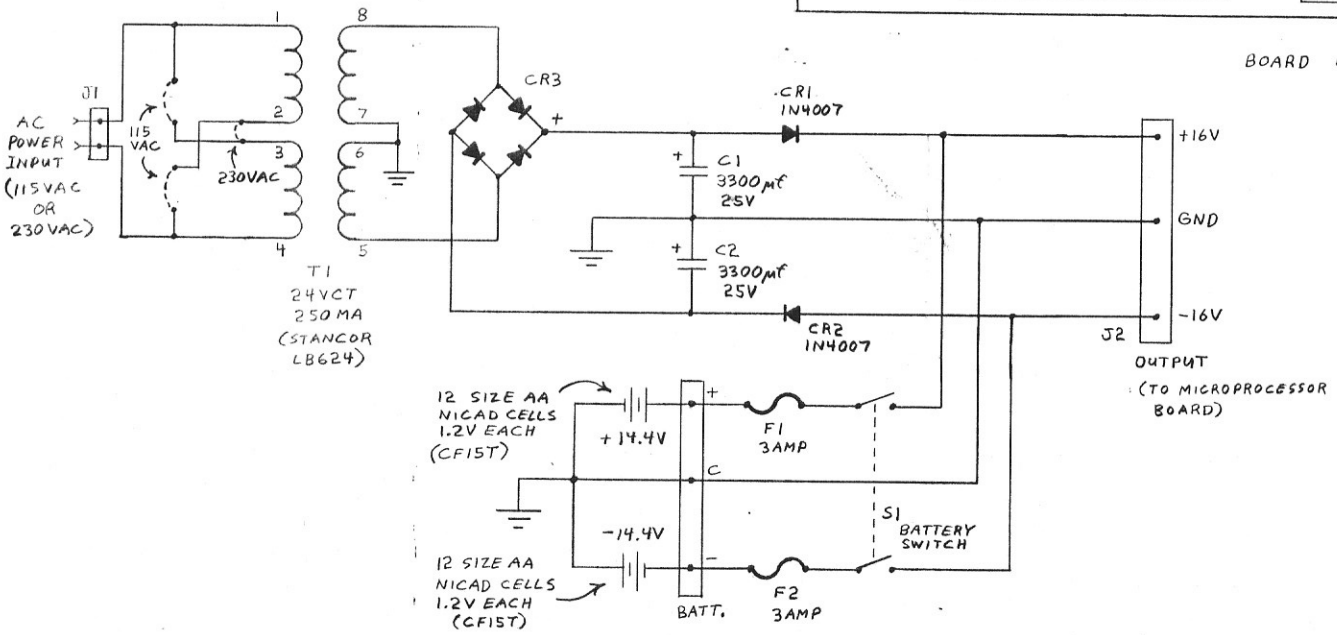
TWO ASSEMBLIES OF
12 SIZE AA NICAD CELLS
(FAST CHARGE TYPE CF1ST OR EQUIV.)
WITH SOLDER TABS



BATTERY LAYOUT FOR EACH OF TWO LAYERS IN BATTERY PACK. EACH LAYER IS CONSTRUCTED AS SHOWN ABOVE, HOWEVER, WHEN MOUNTED ON THE POWER BOARD THE BOTTOM LAYER IS POSITIONED UPSIDE DOWN FROM THE ORIENTATION SHOWN ABOVE. SEE CONSTRUCTION MANUAL FOR COMPLETE DETAILS ON BATTERY PACK FABRICATION AND MOUNTING.



BOARD LAYOUT



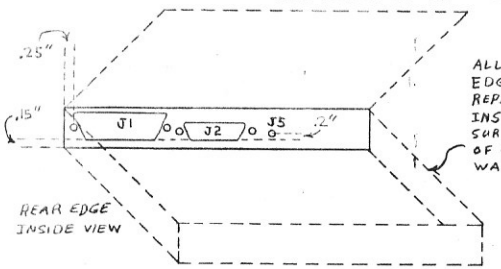
KENTUCKY DEPT. FOR THE BLIND
KENTUCKY PORTABRAILLE POWER BOARD
WAYNE D. THOMPSON 7/85

CASE DETAIL FOR POCKETBRAILLE ONLY

ENCLOSURE USED IS A MEMOREX VHS VIDEO CASSETTE STORAGE CASE.

REMAINING J1 & J2 DIMENSIONS ARE SAME AS PORTABRAILLE REAR PANEL DRAWING BELOW

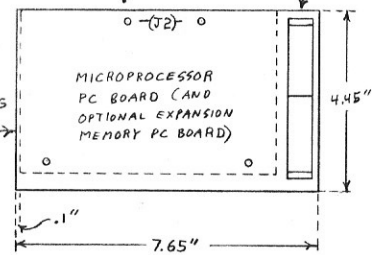
HOLE FOR J5 IS 3/16" DIA.



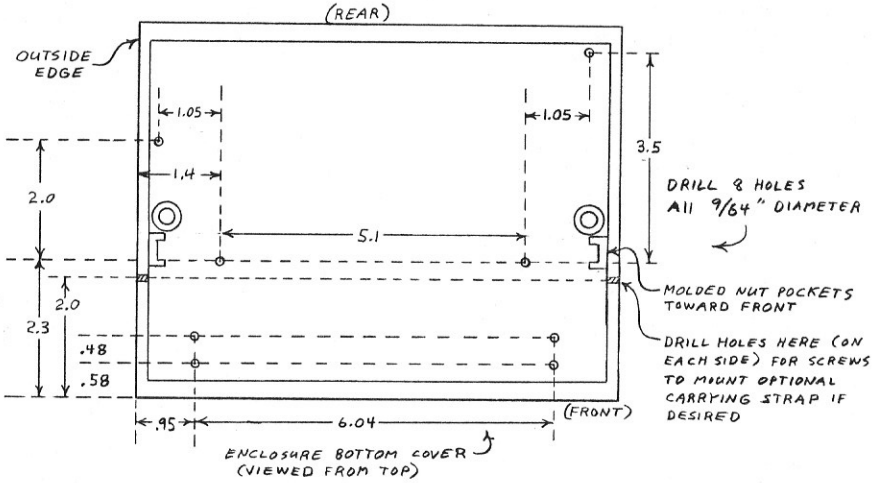
ALL DRAWING EDGES REPRESENT INSIDE SURFACE OF CASE WALLS

LOCATE THESE FOUR MOUNTING HOLES BY POSITIONING PC BOARD IN CASE AND USING IT AS A TEMPLATE TO MARK HOLE CENTERS. DRILL WITH #35 BIT (.110").

2 9V NICAD BATTERIES



TOP VIEW DOWN INTO CASE

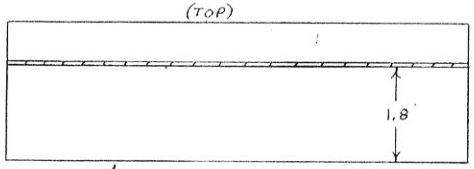


DRILL 8 HOLES ALL 9/64" DIAMETER

MOLDED NUT POCKETS TOWARD FRONT

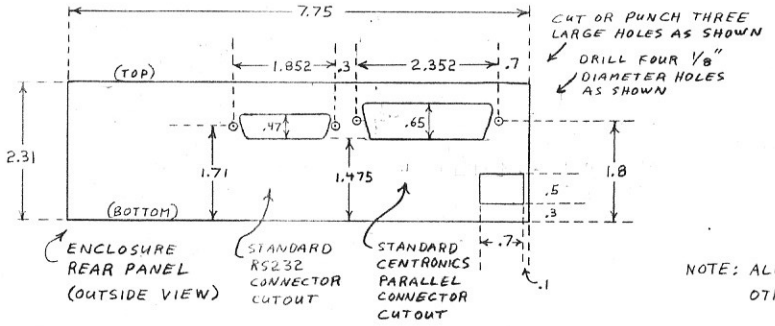
DRILL HOLES HERE (ON EACH SIDE) FOR SCREWS TO MOUNT OPTIONAL CARRYING STRAP IF DESIRED

ENCLOSURE BOTTOM COVER (VIEWED FROM TOP)



ENCLOSURE FRONT PANEL (VIEWED FROM FRONT)

CUT FRONT PANEL HERE USING THINEST SAW BLADE AVAILABLE. THEN, GLUE TOP HALF TO TOP COVER AND BOTTOM HALF TO BOTTOM COVER. (GLUE WITH CUT EDGE AGAINST ENCLOSURE PANEL GROOVE.)



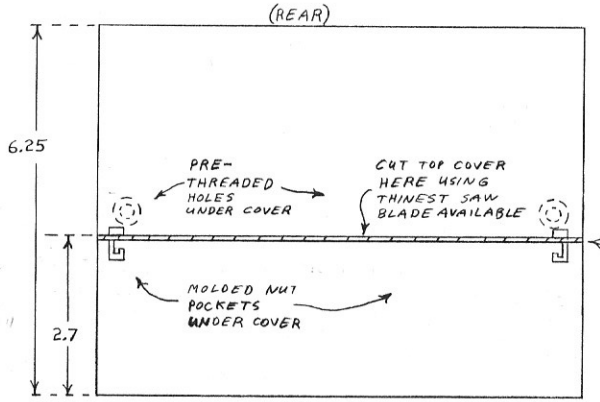
CUT OR PUNCH THREE LARGE HOLES AS SHOWN

DRILL FOUR 1/8" DIAMETER HOLES AS SHOWN

ENCLOSURE REAR PANEL (OUTSIDE VIEW)

STANDARD RS232 CONNECTOR CUTOUT

STANDARD CENTRONICS PARALLEL CONNECTOR CUTOUT



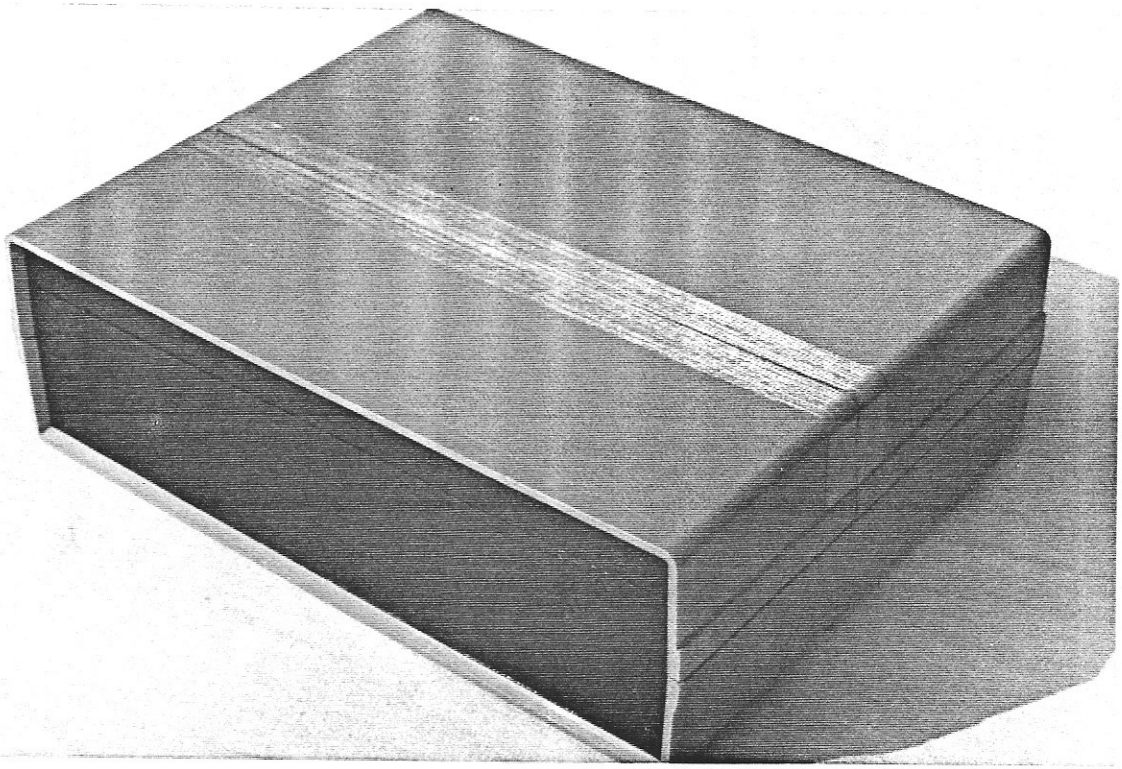
ENCLOSURE IS A PACTEC MODEL CM86-225K BLUE.

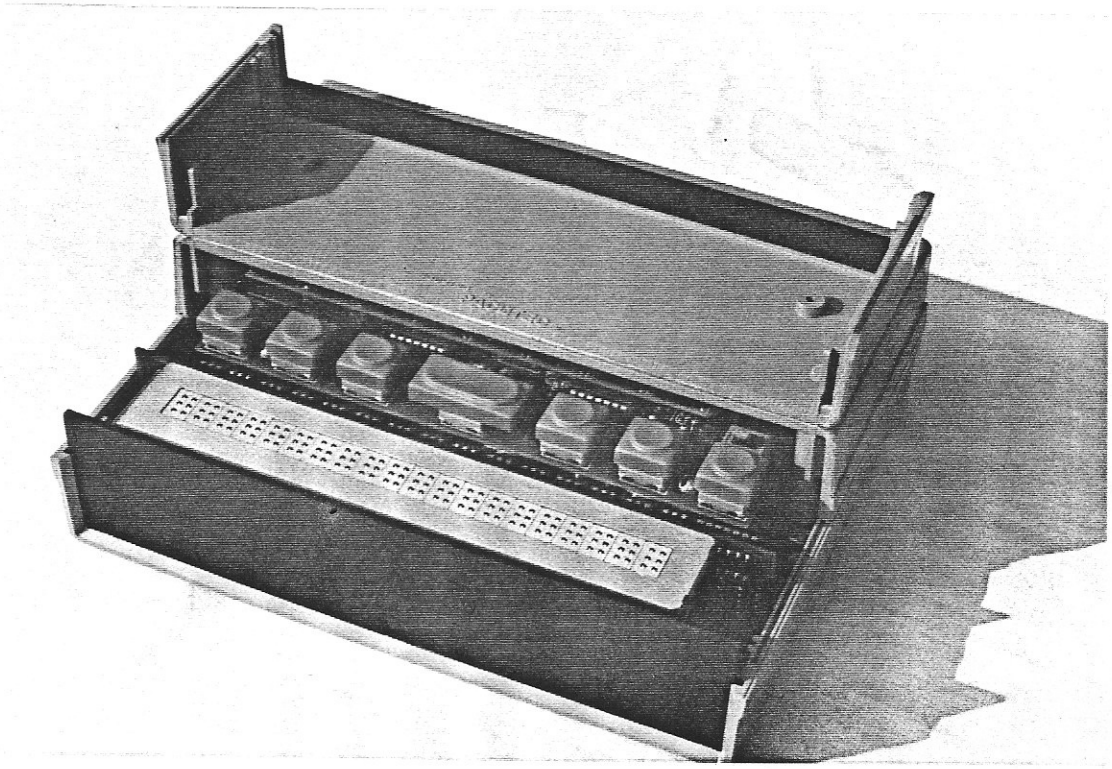
BEFORE MAKING THIS CUT, BE SURE THE TOP COVER IS ORIENTED CORRECTLY. IT IS KEYED TO THE BOTTOM COVER AND WILL ONLY FIT ONE WAY!

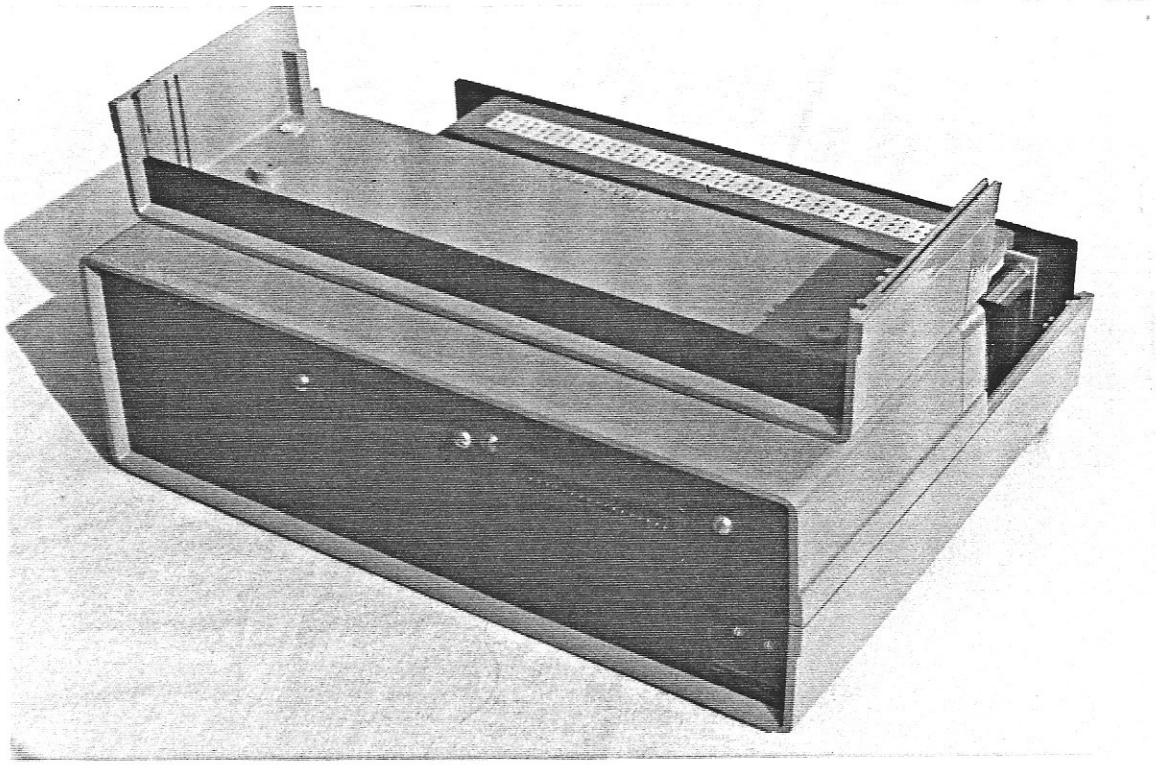
ENCLOSURE TOP COVER (VIEWED FROM TOP)

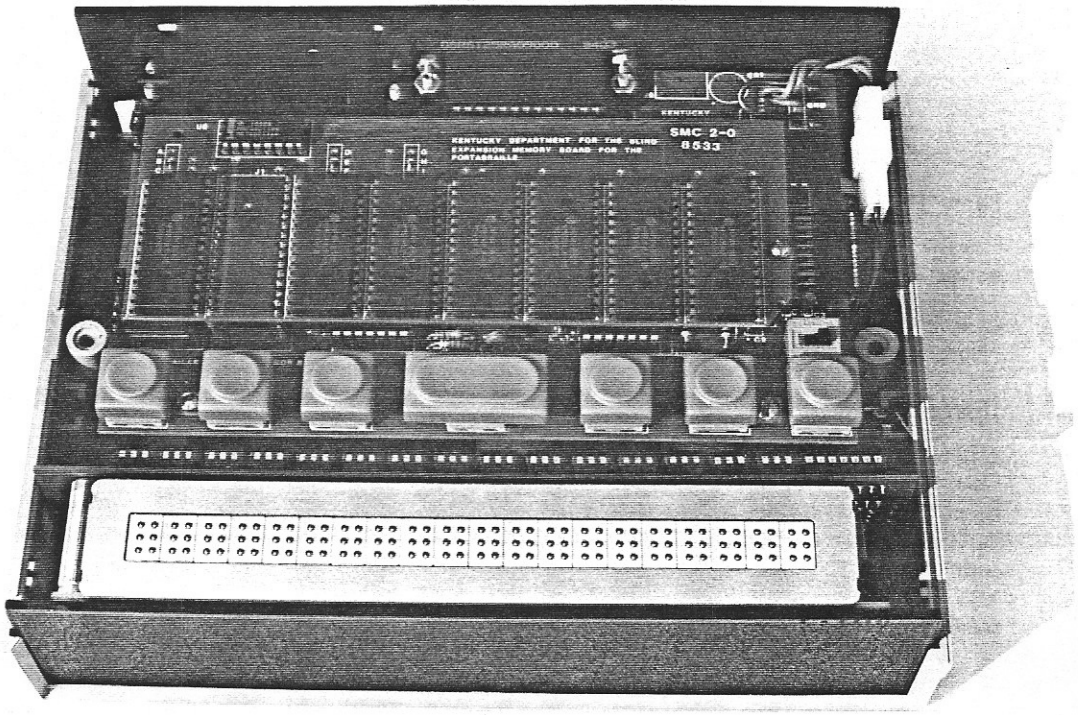
NOTE: ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED. NO SCALE.

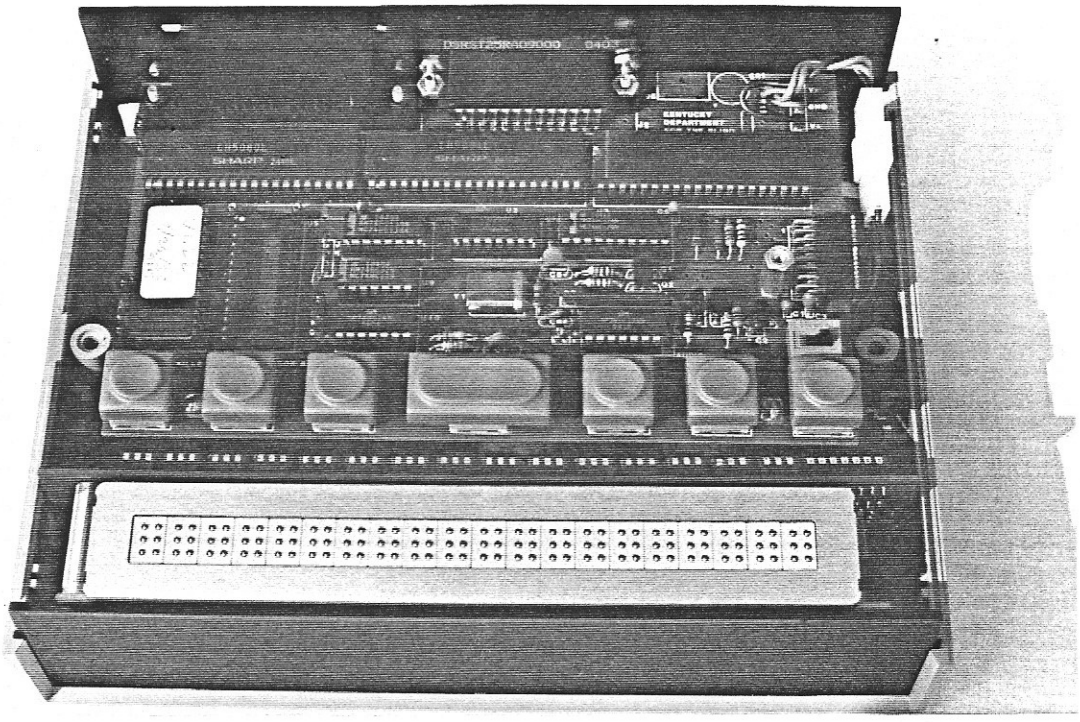
KENTUCKY DEPT. FOR THE BLIND
KENTUCKY PORTABRAILLE AND POCKETBRAILLE CASE DETAILS
WAYNE D. THOMPSON 7/85

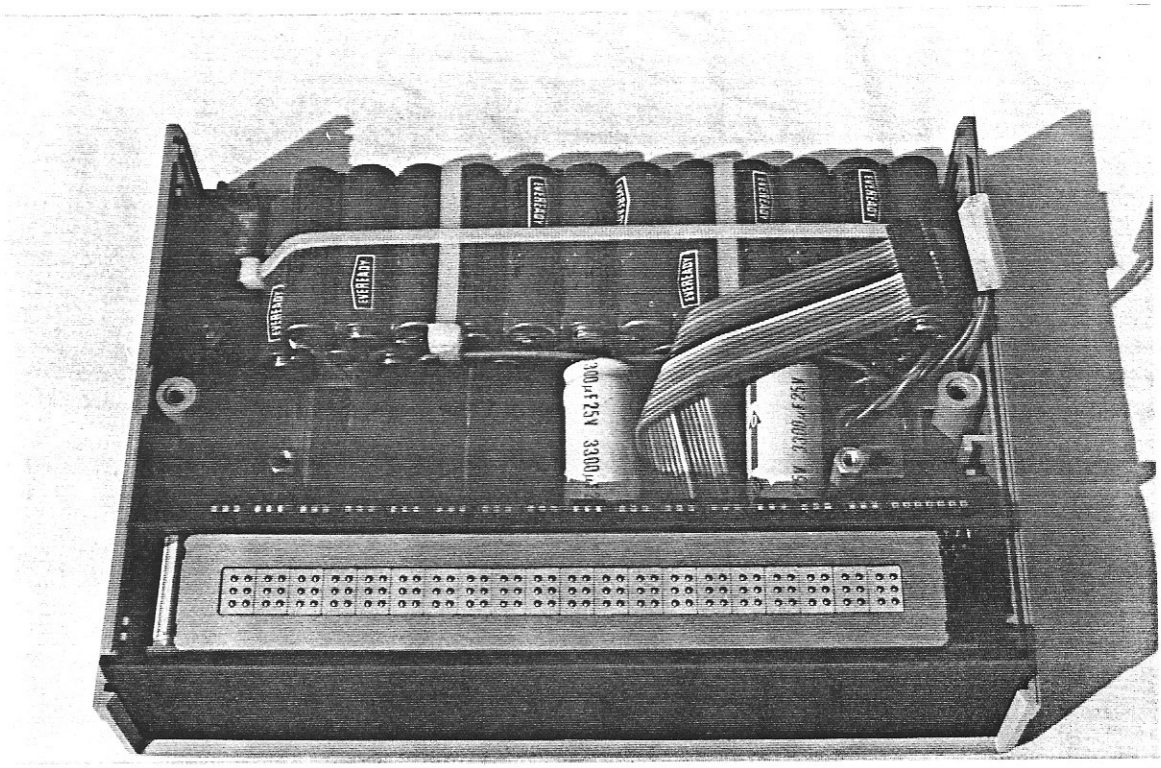


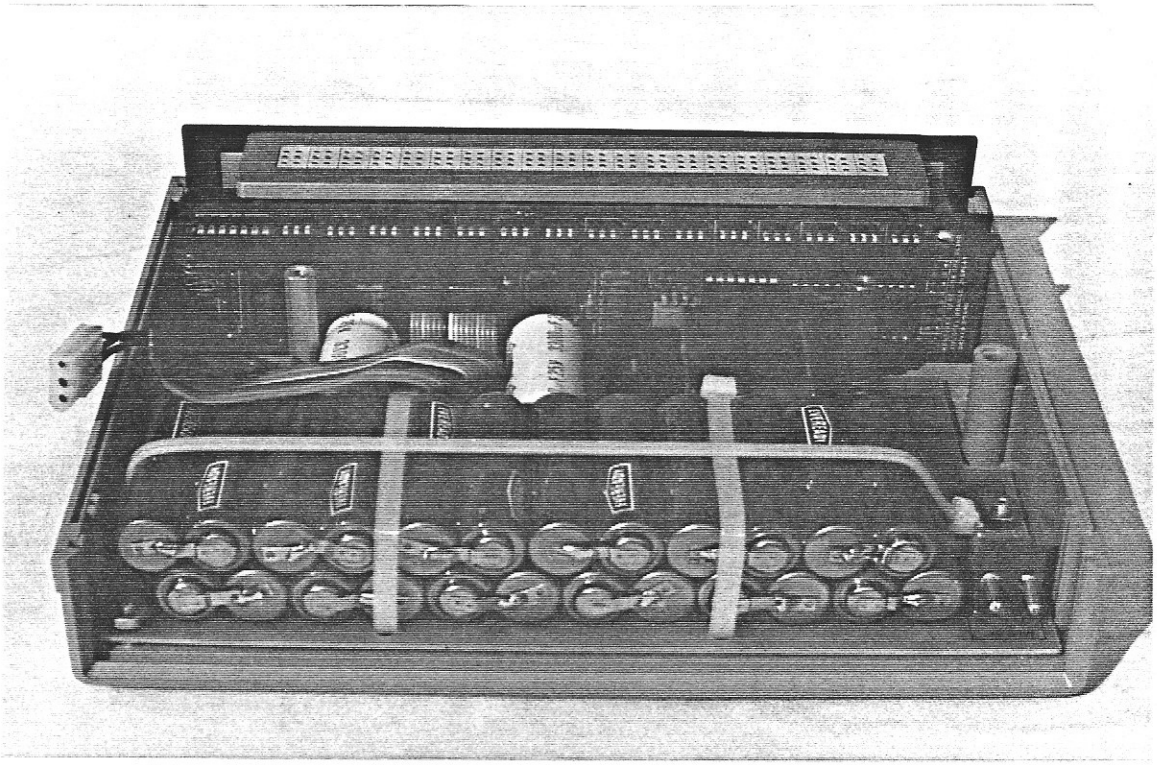


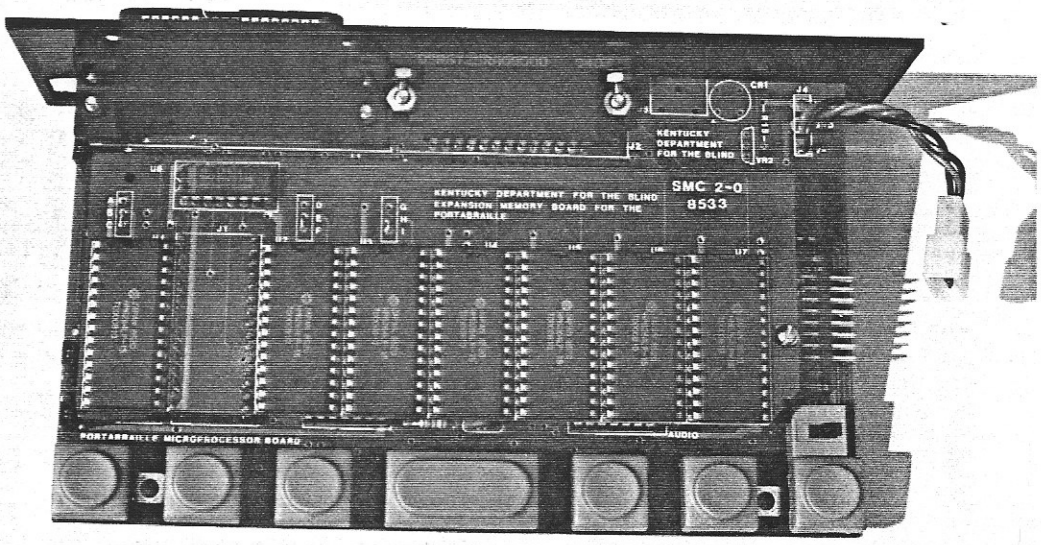


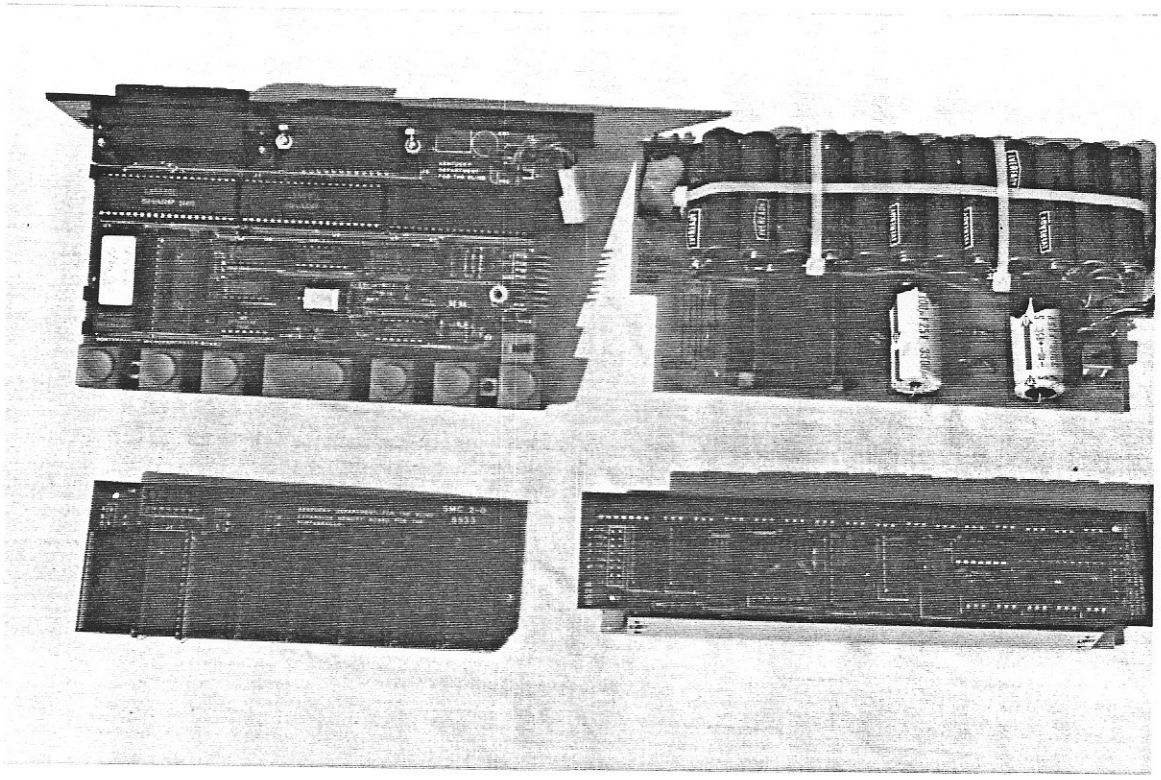

KENTUCKY DEPARTMENT FOR THE BLIND
EXPANSION MEMORY BOARD FOR THE
PORTABRAILLE
KENTUCKY
SMC-2-0
8533

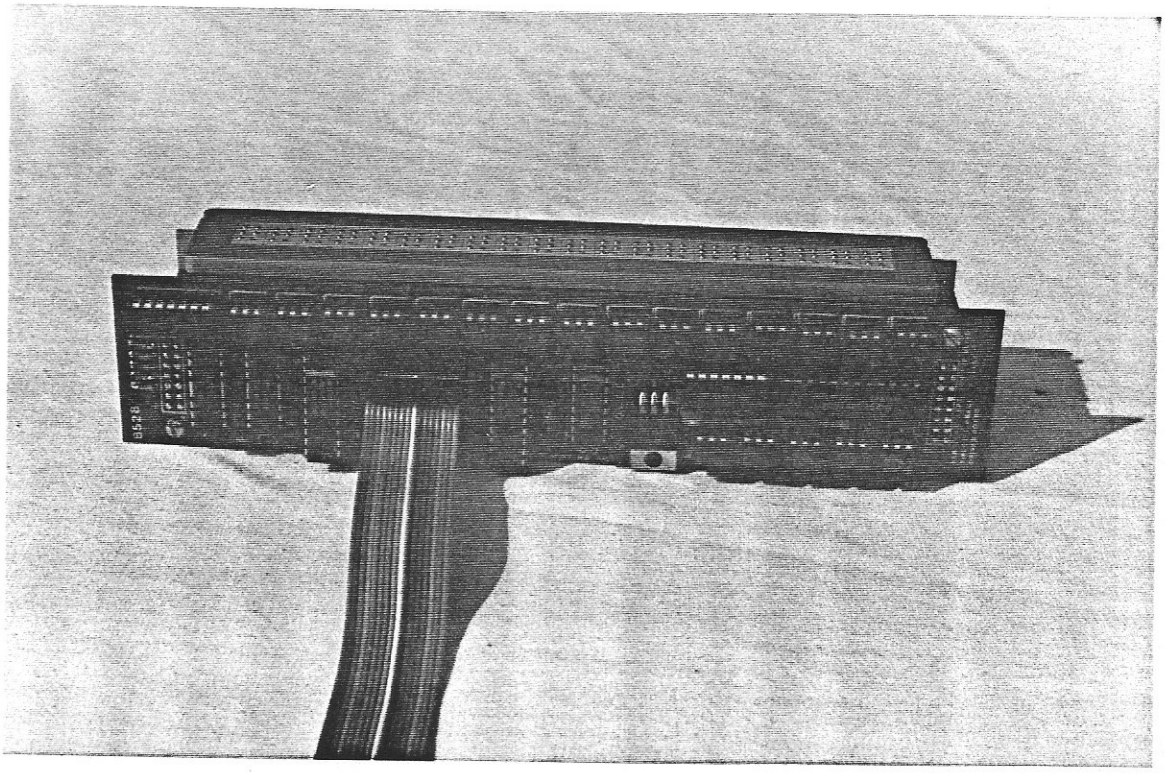


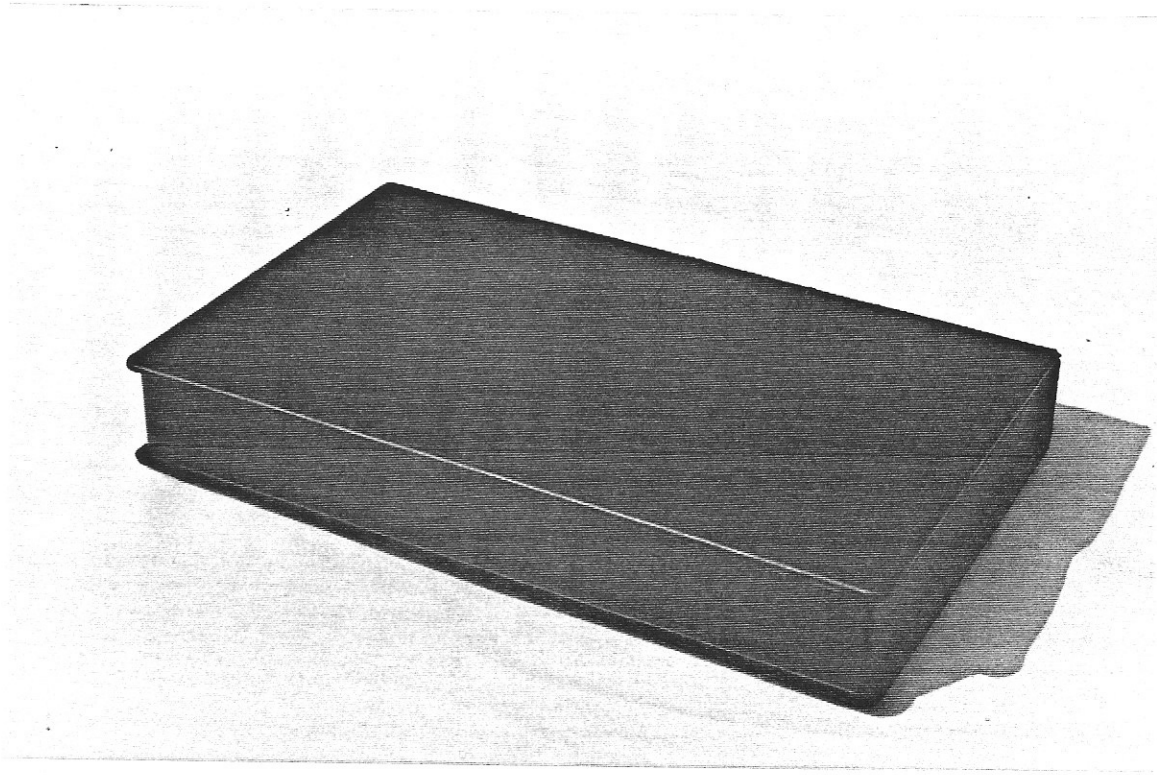

EVEREADY
3300µF25V

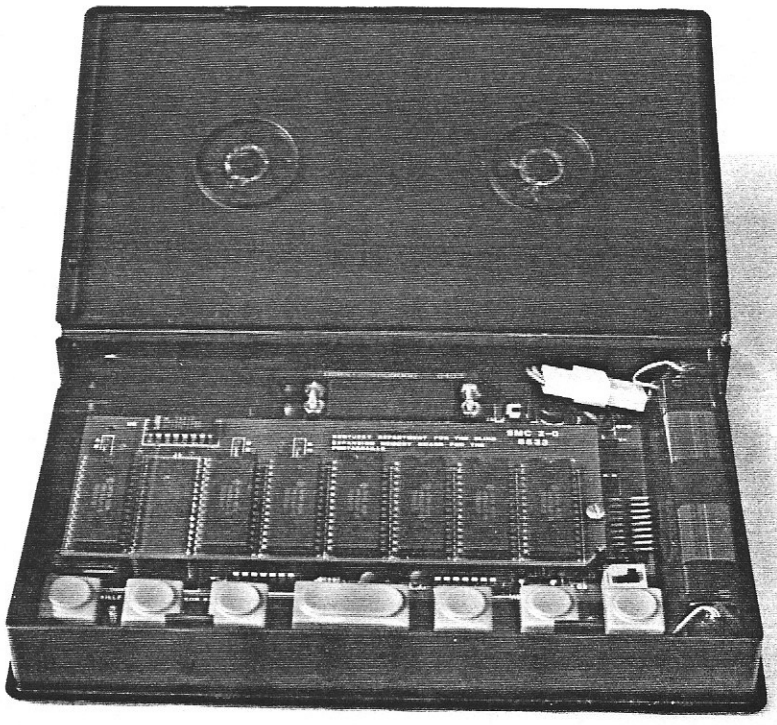


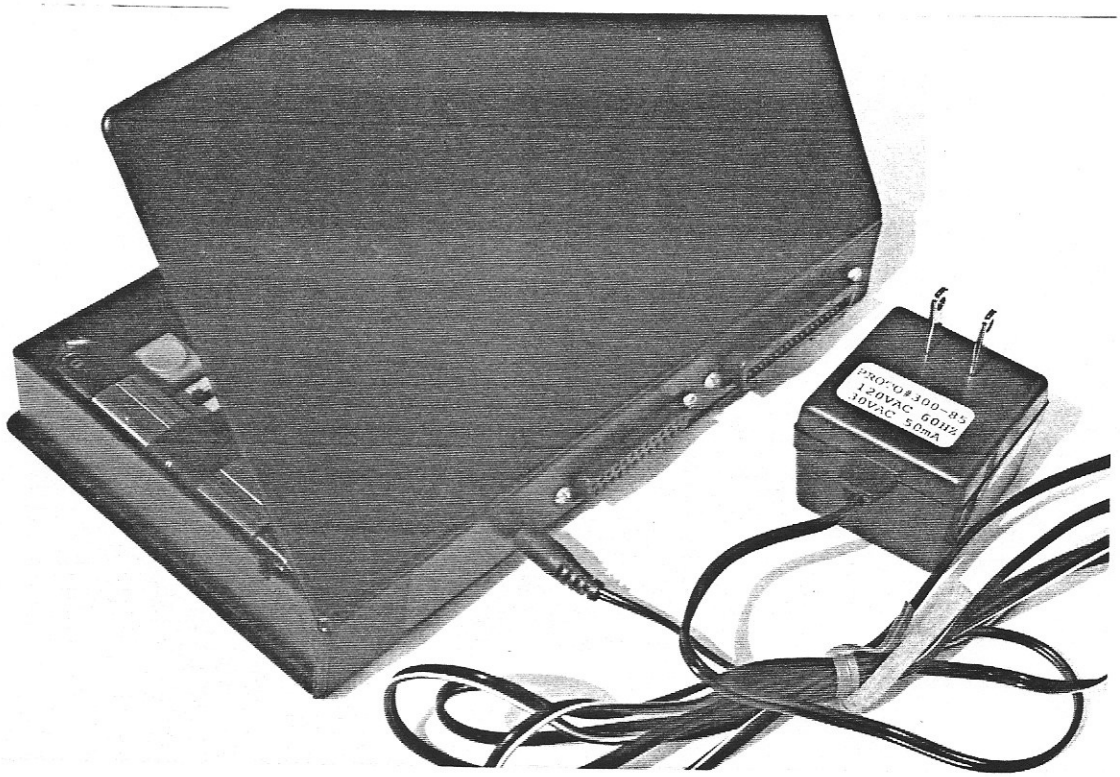

KENTUCKY
DEPARTMENT
FOR THE BLIND
SMC 2-0
8533
KENTUCKY DEPARTMENT FOR THE BLIND
EXPANSION MEMORY BOARD FOR THE
PORTABRAILLE
PORTABRAILLE MICROPROCESSOR BOARD
AUDIO

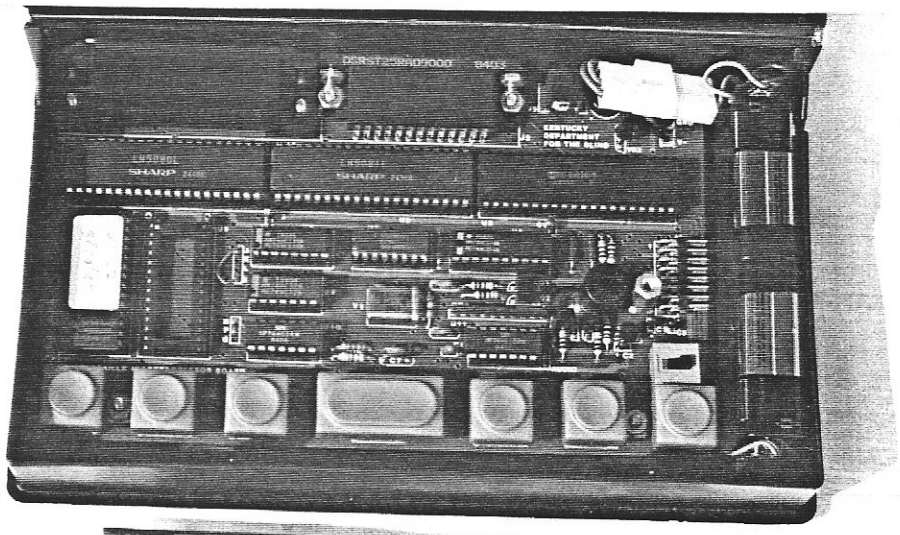


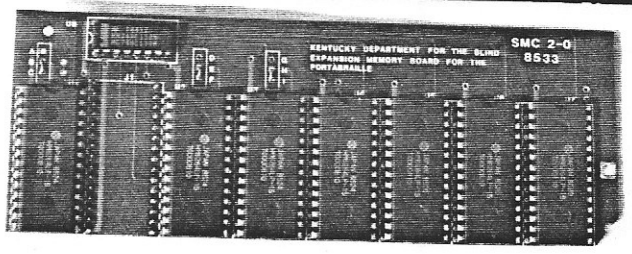







PRO-POWER 300-85
120VAC 60HZ
10VAC 50mA


KENTUCKY DEPARTMENT FOR THE BLIND
SHARP


KENTUCKY DEPARTMENT FOR THE BLIND
EXPANSION MEMORY BOARD FOR THE PORTABRAILLE
SMC 2-0
8533

APPENDIX B: Parts List

This appendix lists all parts used in the Kentucky PortaBraille and the Kentucky PocketBraille.

The vendor and manufacturer code numbers refer to the listing in Appendix C. This list of vendors and manufacturers does not constitute an endorsement by the Kentucky Department for the Blind. It is provided simply as a convenience to builders and usually represents the vendors we have used. You may want to shop around to get the best prices, especially on IC's. If you substitute manufacturers for a part specified , make sure the alternate part is equivalent both electrically and mechanically. Otherwise, it may not work properly or fit properly into the PortaBraille or PocketBraille case.

If you are building the PortaBraille, all parts in this Appendix are required unless otherwise noted. If you are building the PocketBraille, only those parts listed under the section for Microprocessor Board are required except as otherwise noted in the other sections.

Printed circuit boards for both the PortaBraille and the PocketBraille are currently manufactured and available from Southland Manufacturing Company (vendor #16 in Appendix C). Southland has generously volunteered to make these boards available at their cost. The current prices are:

Microprocessor Board - $7
Braille Display Driver Board - $6
Expansion Memory Board - $6
Power Board - $5
(Prepunched rear panel for PortaBraille case - $3)

Of course, these prices are subject to change. Southland also intends to offer, at their cost, completely assembled and tested PortaBrailles and PocketBrailles beginning January, 1986. A complete kit of parts may also become available from Southland, again, at their cost. Contact the Kentucky Department for the Blind for pricing and availability of all these items.

Many other companies and volunteer groups have expressed an interest in marketing the PortaBraille and PocketBraille. Contact the Kentucky Department for the Blind for the latest information on vendors of completed units and parts kits.

16	16	-	1	PortaBraille (and PocketBraille) Microprocessor PC Board
8	-	-	5	#4 x 40 x 3/8" Machine Screws
8	-	-	4	#4 x 40 Nuts
8	-	-	1	#4 Internal Tooth Lockwasher
2	2	- (*8)	28	SC-1P4-GT Lead Sockets

Notes:

(*1) - May substitute HM62256LP-15 32K x 8 RAM chip if desired (available early 1986) or 56K Expansion Memory Board (available now).
(*2) - Required only on the PocketBraille. Change R15 to 120 ohms if 9V Nicad batteries are not the fast charge type specified. The value of R15 will also change if a recharger different than the 30VAC transformer specified is used.
(*3) - One pkg. contains 10; only 1 is needed
(*4) - One pkg. contains 100; only 3 are needed
(*5) - Required only on the PortaBraille
(*6) - Firmware is currently supplied for 27C64 8K EPROMS. Future releases, however, may exceed 8K requiring the use of a 27C128 (16K) or 27C256 (32K) EPROM. Firmware will be burned into your EPROM, free, by vendor #5.
(*7) - R16 is 100 K for PortaBraille; 470K for PocketBraille
(*8) - Optional. Used only on the PocketBraille to raise the height of the keyboard. Reference item 13 in the section on constructing the microprocessor board.

PARTS LIST FOR THE PORTABRAILLE POWER BOARD

VENDOR	MFGR.	SCHEMATIC DESIGNATION	QTY.	PART # AND/OR DESCRIPTION
6	21	T1	1	LB624 24VCT, 250ma Transformer
4	-	CR1,CR2	2	IN4007 Diode
4	-	CR3	1	BR84D-ND 2 Amp Bridge Rectifier
4	5	C1,C2	2	P5052 3300 mf, 25V Electrolytic Cap.
6	20	F1,F2	2	255003 3 Amp Subminiature Fuse
6	9	S1	1	MSSA-204N DPDT Miniature Slide Switch
9	19	J1	2	2FP AC Receptacle (2 prong "cheater")
6	22	-	24	CFI5T Nicad Batteries (Size AA)
16	16	-	1	PortaBraille Power Printed Circuit Board
3	18	- (*1)	1 pkg	T49 Vector Wiring Terminals
6	17	- (*2)	1 pkg	PLT3I-C 11 5/8" Cable Ties
8	-	-	1	5 minute epoxy
6	28	J2 (*3)	1 pkg	03-06-1032 Male Connector
6	28	J2 (*4)	1 pkg	02-06-2103 Female Terminals
8	-	-	1	Silicone Adhesive Sealant

Notes:

(*1) - One pkg. contains 50; only 4 are needed.
(*2) - One pkg. contains 100; only 4 are needed.
(*3) - One pkg. contains 10; only 1 is needed.
(*4) - One pkg. contains 100; only 3 are needed.

CASE AND OTHER MISC. PARTS

VENDOR	MFGR.	SCHEMATIC DESIGNATION	QTY.	PART # AND/OR DESCRIPTION
12	23	-	1	CM86-225K Case (PortaBraille)
8,15,16	24	-(*1) (*4)	1	Plastic VHS Video Cassette Storage Case (PocketBraille) Memorex or equivalent type Amaray AM-H1-CLR
16	-	-	1	Prepunched rear panel for PortaBraille Case
8	-	-	4	3mm x 10mm Machine Screws
8	-	-	6	#6 x 32 Nuts
8	-	-	2	#6 x 32 x 1" Machine Screws
8	-	-	4	#6 x 32 x 3/8" Machine Screws
9	-	-	2	#6 x 32 x 1" Hex Threaded Spacer
8	-	-	12"	1" wide piece of filament tape
9	-	- (*2)	3'	22 gauge insulated hookup wire
8	-	- (*2)	2	#4 x 40 Nuts
8	-	- (*2)	4	#4 x 40 x 3/8" Machine Screws
8	-	- (*1)	4	#4 x 40 x 1/2" Machine Screws
8	-	- (*1)	6	#4 x 40 Nuts
8	-	- (*3)	1	Carrying Strap and associated hardware (optional)
13	25	- (*1)	2	9V Nicad Fast Charge Batteries (23-126)
9	26	- (*1)	2	9V Battery Snaps (Model L8)
13	25	- (*1)	4	Self adhesive rubber feet (64-2346)
16	27	- (*1)	1	30VAC, 50 MA Wall Transformer with sub-mini (2.5mm) phone plug attached.
9	-	-	1	6', two prong, non-polarized 120VAC cheater cord

Notes:

(*1) - These parts are needed only for the PocketBraille. They are not needed for the PortaBraille.
(*2) - Needed for both the PocketBraille and PortaBraille.
(*3) - See Part One section "Case Preparation", item #10.
(*4) - "Pre-punched" PocketBraille cases may be available from vendor #16

VENDOR ADDRESSES AND PHONE NUMBERS

1. Sharp Electronics Corp.
   Electronics Components Group
   10 Sharp Plaza
   Paramus, N.J. 07652
   201-265-5600

2. Samtec, Inc.
   P.O. Box 1147
   New Albany, IN 47150
   812-944-6733

3. Jameco Electronics
   1355 Shoreway Road
   Belmont, CA 94002
   415-592-8097

4. Digi-Key Corporation
   701 Brooks Avenue, South
   P.O. Box 677
   Thief River Falls, MN 56701
   800-344-4539

5. Kentucky Department for the Blind
   427 Versailles Road
   Frankfort, KY 40601
   502-564-4754

6. Newark Electronics
   1313 Lyndon Lane
   Louisville, KY 40222
   502-423-0280

7. *Marcum Switches, Inc.
   67 Albany Street
   Cazenovia, N.Y. 13035
   315-655-8050

8. Local Hardware or Department Store

9. Local Electronics Distributor

10. JDR Microdevices
    1224 S. Bascom Avenue
    San Jose, CA 95128
    800-538-5000 or 800-662-6279 (CA)

11. Tiflotel
    24032 Calolziocorte
    Bergamo
    Italy
    Tel. (0341) 642.292

12. Prehler Electronics, Inc.
    2300 N. Kilbourn Avenue
    Chicago, IL 60639
    312-384-6100

13. Local Radio Shack Store

14. (Deleted)

15. Videotape Products, Inc.
    320 N. Madison Avenue
    Los Angeles, CA 90004
    213-664-1144

16. Southland Manufacturing Co.
    680 Bizzell Drive
    Lexington, KY 40510
    606-253-3066

* Marcum has a minimum order of $50. A kit containing only the seven switches used in the PortaBraille (or PocketBraille) is available for $15 postpaid from:

Selectaswitch, Inc.
P.O. Box 1585
Codena, CA 91722
818-967-4119

Send money order or cashiers check and ask for the "Kentucky PortaBraille Switch Kit".

1) An occasional overcharge of several hours beyond the recommended eight hours will not harm the batteries.

2) If you plan to power the PortaBraille from AC power for an extended time, turn off the battery switch located on the power board.

3) If the batteries need recharging at a time when you need to use the PortaBraille, you may do both simultaneously.

4) Avoid recharging the batteries before they become fully discharged since this may reduce their charge capacity. They are considered fully discharged when they will no longer operate the braille display reliably. You should recharge them at this point.

5) Avoid accidentally storing the PortaBraille in the "on" position using battery power for a month or more since the batteries could be damaged by too great a discharge.

6) If the braille display becomes weak due to low batteries in the middle of a work session, you may plug in the AC line cord without turning off the PortaBraille. This will re-establish full power for the display without disturbing the data in memory. No data is retained when the PortaBraille is turned off.

All the above instructions and recommendations for the PortaBraille also apply to the PocketBraille with the following exceptions:

1) The PocketBraille uses two 9V fast charge Ni-cad batteries and can be fully recharged in 4 hours. If you do not use the fast charge batteries specified, R15 must be changed to 120 ohms and the minimum charge time increased to 14 hours.

2) Instead of an AC line cord, the PocketBraille is charged with a 30VAC wall adapter terminated with a submini phone plug (2.5mm) which plugs into J5 on the rear of the PocketBraille.

3) A full charge will last about ten hours with heavy keyboard and/or I/O usage. With light or no keyboard and I/O usage, a full charge will keep the PocketBraille continously powered up for several days.

CONSTRUCTION MANUAL
for the
KENTUCKY PORTABRAILLE
and the
KENTUCKY POCKETBRAILLE

KENTUCKY DEPARTMENT FOR THE BLIND
TECHNICAL SERVICES UNIT
427 VERSAILLES ROAD
FRANKFORT, KENTUCKY 40601
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WAYNE D. THOMPSON, P.E.
August, 1985

(Revised - May, 1986)

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PART ONE: THE KENTUCKY PORTABRAILLE
INTRODUCTION

This part of the manual provides complete instructions on how to build a Kentucky PortaBraille. It does not contain user operating procedures which may be found in the Kentucky PortaBraille/PocketBraille Users Guide.

The PortaBraille is an intelligent communication device for the blind and deaf-blind. It can send and receive ASCII data using a built-in 20-cell refreshable braille display and seven-key braille keyboard. It can also be used as a note-taking device by typing directly into its 256K memory. The PortaBraille is battery powered and very portable. It weighs under four pounds and measures approximately 8" x 6" x 2 1/2". With a full battery charge the unit can operate under heavy continuous use for at least ten hours. Under typical usage, a full charge will last for days or even weeks. Power consumption is only significant while the braille display is actually changing. The batteries are automatically recharged whenever the AC plug-in wall transformer is connected. The batteries and charging circuit are built into the PortaBraille. The only external part is the detachable wall transformer.

Other built-in features include up to 256K of RAM; 32K EPROM; Centronics compatible parallel input or output; RS232C serial input/output; 7-key braille keyboard; settable baud rates and other communication parameters; upper case, lower case, and control character display capability; generation of all 128 ASCII characters; full or half-duplex operation; columnar data display mode; self-test mode; speech capability; and many other operational features we are constantly adding to the PortaBraille's firmware.

The major design objective of this project was low cost. There is no shortage of high technology devices available for the blind that are too expensive for individual ownership. The total parts cost for the PortaBraille is about $800. It can be constructed in about ten hours by anyone with only moderate experience in assembling printed circuit boards. No special tools or knowledge is required. All printed circuit boards that go into the PortaBraille have been designed by the Kentucky Department for the Blind. As a convenience to builders and cost savings to users, all printed circuit boards are available at manufacturer's cost as described in Appendix B. Also, we will place, at no charge, the latest firmware into an EPROM furnished by you.

All technical information related to the PortaBraille has been released to the general public and is considered public domain information. We encourage any copying and distribution of this information to interested parties. We encourage and will support, as much as possible, any efforts to build

"CASE PREPARATION FOR THE KENTUCKY PORTABRAILLE"

The case that houses all the components of the Kentucky PortaBraille is about 8" x 6" x 2 1/2". A few modifications must be made to the case before the circuit boards and braille display can be mounted inside. There are four separate pieces to the case; the bottom cover, top cover, front panel, and rear panel. Follow the steps below to prepare these parts for the final assembly section later.

1) Saw the front panel into two pieces as shown on the drawings. Use the thinnest saw blade available. A band saw, if available, will make a clean, straight cut.

2) Make holes in the rear panel as shown on the drawings. (A pre-punched rear panel may be available from vendor #16.)

3) Saw the top cover into two pieces as shown on the drawings using the thinnest saw blade available. Again, a band saw makes a nice cut. Note that the top cover is the one with the threaded inserts used to accept the two screws that clamp it to the bottom cover. (The bottom cover has clear holes at these two locations.) Before sawing, be sure the top cover is oriented correctly; that is, the nut pockets molded into the inside side walls should be toward the front and the saw cut will pass right through them. The top and bottom covers fit together only one way, so if you saw the wrong end of this top cover you will ruin the case.

4) Drill holes in the bottom cover as shown on the drawings. Again, be sure the bottom cover is oriented correctly before drilling. The front end should contain the molded nut pockets on the inside side walls.

5) Place a thin layer of 5-minute epoxy in the front panel groove of the bottom cover and front panel groove of the top cover (but not in the side grooves). Place the larger piece of front panel into the front panel groove of the bottom cover with the cut edge into the groove with epoxy. Place the small piece of front panel into the groove of the front half of the top cover with the cut edge into the groove with epoxy. To be sure the front panel pieces will meet properly, temporarily place this smaller piece of the top cover (with its small piece of front panel) on top of the bottom cover. Let the two front panel pieces move out of their grooves slightly if necessary so that the factory edges meet all the way across. Make sure the front edges of side walls are flush with each other. Let the epoxy cure in this position. Be sure that no epoxy from the top cover meets the bottom cover.

"MICROPROCESSOR BOARD FOR THE KENTUCKY PORTABRAILLE AND THE KENTUCKY POCKETBRAILLE"
(and Optional 256K RAM/Speech Board)

General Description

This pc board and circuit was designed by the Kentucky Department for the Blind for use in the Kentucky PortaBraille. It is a CMOS Z80 based design with on-board firmware to control all functions of the PortaBraille or PocketBraille. The circuit is implemented entirely with high speed CMOS technology to permit battery operation. Features include up to 256K of RAM; 32K EPROM; RS232C I/O connector; parallel centronics compatible input or output connector; 7-key braille keyboard; and an output connector designed to connect directly to the Kentucky Driver Board for the Tiflotel Braille Display. Many parameters and modes of operation may be selected by the user through commands entered on the braille keyboard. Operating procedures are covered in the Kentucky PortaBraille/PocketBraille Users Guide.

Board Assembly

This microprocessor board is easy to assemble. When complete, it mounts inside the PortaBraille or PocketBraille case. Perform the following steps to assemble the board:

1) Inspect the pc board carefully for any obvious flaws. It is much easier to spot an imperfection in a trace now than later when all the parts are mounted. All the following parts are mounted on the component side, that is, the side that has the printed component designations. Reference the drawings in Appendix A throughout the following steps.

2) Solder low profile sockets in the indicated positions for all integrated circuits. If pin 1 is indicated on the sockets, be sure to orient them correctly as shown on the board surface and attached drawings.

3) Memory configuration straps A through Q are provided so that the entire 64K address space of the Z80 can be utilized efficiently in a variety of RAM to ROM ratios. At the time of this writing, firmware is being supplied in 32K EPROMS. Socket U5 may contain a 32K x 8 CMOS RAM or, it can be used as the connector to a piggybacked 256K RAM/Speech board. Install the straps as shown on the microprocessor board layout drawing.

4) Solder all resistors, capacitors, and transistors in the positions indicated. Observe proper orientation on polarized components. VR2 is required only if you are building a PocketBraille. For the PortaBraille, short the two upper pads of VR2 together (I and O).

If your cabinet back panel does not yet have the holes made as shown in the drawings, then you will have to postpone the rest of this step until the back panel is prepared. Also, if you are building a PocketBraille omit the rest of this step. Otherwise, mount the back panel to the microprocessor board by inserting J1 and J2 through their respective holes and tightening down with four #4 x 40 x 3/8" screws inserted from the outside of the back panel in toward the connectors. J1's holes are threaded and require no nuts. J2, however, will require two 4 x 40 nuts. There is barely enough clearance on J2 to position these two nuts. In fact, you will have to turn the nut and hex spacer on J2 such that a flat edge is parallel to the rear panel in order to gain enough clearance to position these two nuts. Even then they may have to be wedged firmly into position. Tighten all four screws securely.

12) On the PortaBraille only, solder one side of three in-line fuse holder assemblies to the three pads at J4. Twist the wires a few times to group the three wires together. This forms the power input cable and will later connect to the battery pack.

13) Install and solder keyswitches Key 1 through Key 6 and Key SP as shown. Key SP is the space key and is wider than the other six. Due to the mounting pins on the keyswitches, they can only be inserted one way. Make sure each key is firmly against the board surface before soldering the pins.

    If you are building a PocketBraille, you may prefer the keys to be mounted higher (flush with the inside top cover). If so, insert and solder the 28 lead sockets specified in the parts list, 4 per keyswitch at each switch location. Then mount and solder the keyswitches on these raised lead sockets. Solder the two metal contact pins; epoxy the two plastic mounting pins. Some users might find this raised keyboard preferable to the somewhat recessed location obtained without the lead sockets. Of course, if you mount the board in another case of your own design or choosing, then the keyboard might not be recessed and these lead sockets would not be needed.

14) Insert all integrated circuits in their corresponding sockets observing proper orientation. Handle chips in a static-free environment since they are CMOS. (The firmware, to be placed in EPROM U4, is available from the Kentucky Department for the Blind for free by sending us your EPROM for programming). If you are not installing the 256K RAM/Speech board, then the microprocessor board is now complete. Otherwise, complete the remaining steps below.

"BRAILLE DISPLAY DRIVER BOARD FOR THE KENTUCKY PORTABRAILLE"

General Description

This pc board and circuit was designed by the Kentucky Department for the Blind for use in the Kentucky PortaBraille. It contains all the electronics required to actuate the Tiflotel 20-cell braille display Model 51.820.M6 and is a completely solid state, low power design.

The two later sections on hardware and software interfacing are detailed explanations of the protocol and interfacing of this driver board directly to a host system other than the PortaBraille. If your host system is the PortaBraille, then this board will simply plug into the PortaBraille's microprocessor board and it is not necessary to read or understand the information in those two sections. The Kentucky PortaBraille has been designed to interface directly with this driver board.

Board Assembly

This driver board is easy to assemble. When complete, it simply plugs onto the back of the Tiflotel braille display creating a compact, one-piece unit only slightly larger than the Tiflotel braille display alone. Perform the following steps to assemble the board:

1) Inspect the pc board carefully for any obvious flaws.

2) Solder low profile sockets on the component side of the board for integrated circuits U1 through U29 in the locations indicated. If pin one is indicated on the sockets, be sure to orient them correctly as shown on the board surface and attached drawings. All IC's are not oriented alike.

3) Solder the following discrete parts on the component side as indicated: resistors, capacitors, transistors, diodes, and voltage regulator. Observe proper polarity and orientation on some of these parts. Note that the diodes are easily damaged by excessive heat from a soldering iron. Test all six diodes with a VOM both before and after installation. A shorted diode will damage other components when power is applied.

4) Solder an insulated jumper wire on the component side between pads marked A and B.

5) Place J3 at the proper location on the component side and solder to pads located on the non-component side just as you did the IC sockets. Note that the solder tail pins on J3 are the short pins; the side with the longest pins should point up and will later mate with a female

or top of the display. Secure the Kentucky driver board to the threaded spacers mounted on the Tiflotel unit with two #4 x 40 x 3/8" screws. There should be a resulting clearance of about 1/16" between the tips of the socket solder tails and the back surface of the Tiflotel unit.

9) The driver board is now complete and ready for use. It has essentially become an integral part of the Tiflotel display suitable for interfacing to the Kentucky PortaBraille or any other host computer system as described in the next two sections. (Again, if you are using this driver board as part of a Kentucky PortaBraille, then it is not necessary to read or understand these next two sections).

Software Interfacing

There are two basic operations performed by the driver board; write to a cell and erase a cell. Any one of the twenty cells may be erased or written at any time. Only one cell may be changed at a time and a cell must first be erased before it is written. The driver board appears as one 8-bit data output port address to the host and all data bytes sent to the driver board must have the following format:

Cell Address or Pin Data - D0 through D5

Mode Bits - D7, D6
- 00 = Select Cell
- 01 = Write Cell
- 10 = Select and Erase Cell
- 11 = Not Used

To erase a cell, the host must send two bytes to the driver board. The first byte must have bit 7 high, bit 6 low, and bits 0 through 5 must contain the cell address in binary from one to twenty. This will cause erase power to be applied to the selected cell. After an 11 msec delay, the host must send a zero byte (all bits low) to the driver board to remove erase power and de-select the cell. A delay of at least 7 msec is then required before a new sequence may begin.

To write a new dot pattern to a cell the host must send four bytes to the driver board and the cell must have been previously erased.

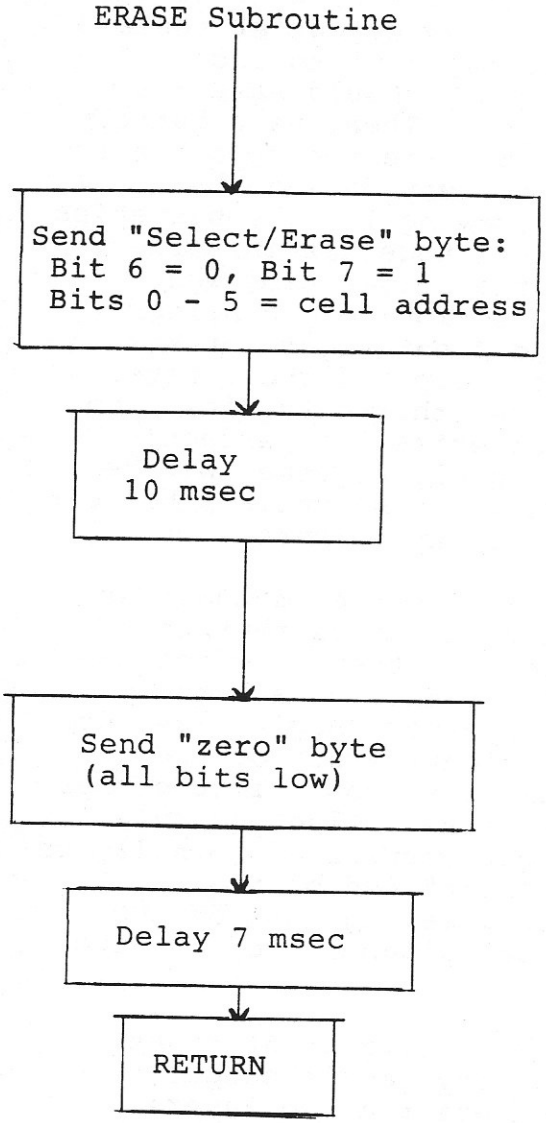
The first byte selects a cell for writing. Bits 6 and 7 must be low and bits 0 through 5 must contain the cell address in binary from one to twenty.

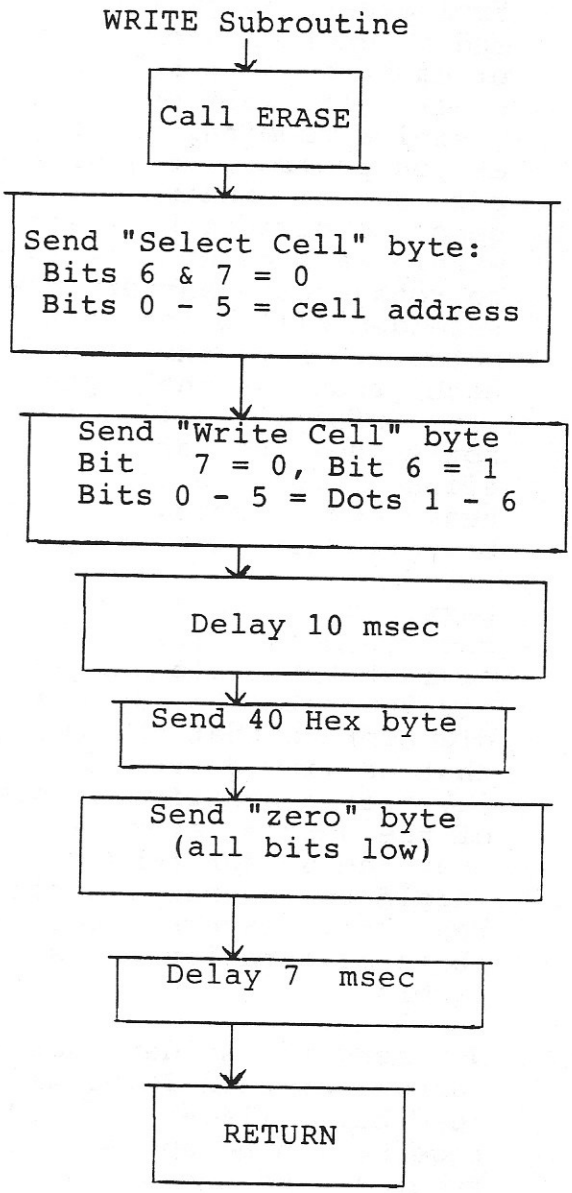
The second byte contains the pin data and may immediately follow the first byte. Bit 7 must be low, bit six must be high, and bits 0 through 5 contain the pin data corresponding to dots 1 through 6 respectively. A high bit means raise the dot, a low bit means leave the dot lowered. This byte causes write power to be applied to the desired dots of the selected cell. The host must now delay for 10 msec.

The third byte must be sent after the 10 msec delay described above and serves to remove write power from the pins. This byte should have only bit 6 high, that is, a value of 40 hex.

The fourth and final byte may immediately follow the third byte described above. It de-selects the cell and returns the display and driver circuit to a low power, stand-by condition. This must be a zero byte (all bits low) and a delay of at least 7 msec is required after this byte is sent before a new sequence may begin.

SOFTWARE DRIVERS FOR THE KENTUCKY DRIVER BOARD
FOR THE TIFLOTEL BRAILLE DISPLAY MODEL 51.820.M6




WRITE Subroutine
Call ERASE
Send "Select Cell" byte:
Bits 6 & 7 = 0
Bits 0 - 5 = cell address
Send "Write Cell" byte
Bit 7 = 0, Bit 6 = 1
Bits 0 - 5 = Dots 1 - 6
Delay 10 msec
Send 40 Hex byte
Send "zero" byte
(all bits low)
Delay 7 msec
RETURN

Connect the battery pack to the remaining three halves of the in-line fuse connectors. Mark the wires clearly so they will be properly matched to the microprocessor board when fuses are installed and fuse holders are connected. Cover all exposed battery connections with electrical tape. Finally mount the battery pack to the bottom cover with a 6" strip of 3/4" x 1/16 double-sided foam tape.

the scope of this manual. However, the circuit design is a fairly conventional application of a microprocessor and any competent technician or engineer (armed with the schematic and a logic probe) should be able to devise a strategy to isolate the problem. If a 256K RAM/Speech board is installed, you may have to temporarily replace it with a single RAM chip in socket U5 of the microprocessor board in order to have easy access to test points on the microprocessor board. The following hints might be of some help:

1) Are the fuses good?

2) Check for +5V on the microprocessor board.

3) Check for a brief low pulse at pin 26 of the Z80 at power on.

4) Is the clock running? (Check U7, pin 9).

5) The Z80 HALT line (pin 18) should go low about 1/2 second after power on. If it does, the program would appear to be running.

6) Is the driver board connected properly?

7) Is +5V present on the driver board?

8) Pin 1 of U6 on the driver board should show a train of pulses lasting for about 1/2 second after power on. Likewise, at U8, pin 8 on the driver board. If so, check Q2.

9) Call us. We will be glad to help if we can.

4) Turn the power switch off. Hold down key 2 while turning the power switch back on. Release key 2 when the display becomes active. The PortaBraille should now be in a self-test mode. The display will change every 4 seconds until you terminate the self-test by turning the unit off. This is a good time to verify that all dots are working. The self-test mode repeatedly displays five different patterns, each for three seconds. First, all dots 1 and 4 are raised. Next, dots 2 and 5; then dots 3 and 6; then all dots; then no dots. The pattern repeats indefinitely. The delay between lines gives you an opportunity to inspect the display for missing or stuck dots. Note that if your finger is touching a cell when it tries to change, the dot pattern may not come up correctly (but you will not damage the display by doing this).

5) After performing the self-test, turn the PortaBraille power switch off. Install the top cover by lowering it onto the unit and guiding the rear panel into the grooves

"CASSETTE TAPE INTERFACE FOR THE KENTUCKY PORTABRAILLE/POCKETBRAILLE"

General Description

This pc board and circuit was designed by the Kentucky Department for the Blind for use with the Kentucky PortaBraille/PocketBraille (PB). It is an accessory to the PB and gives the user a means of mass storage by allowing data within the PB to be saved on audio cassette tape at 2400 Baud using any ordinary audio tape recorder.

The interface in its box is very small (4" x 2 1/2" x 1") and plugs directly onto the RS232 connector on the PB. It is powerered by its own 9V battery and has two mini-phone jacks for connecting to any tape recorder. A mini-phone plug cable is used to connect one of these jacks to the microphone or auxiliary input of a tape recorder for saving data. Later, the cable is plugged into the other jack and routed to the tape player's earphone or other output jack for loading data back into the PB. The interface also has an on/off switch and audio indicator which lets the user know when data is being transferred.

Board Assembly

This tape interface board can be easily assembled in less than one hour. Perform the following steps to assemble the board.

1) Inspect the pc board carefully for any obvious flaws.

2) Solder the IC sockets and all other parts to the board as shown on the drawings in Appendix A. Place a small piece of tape under the crystal to avoid shorting of board pads or traces by the crystal's metal casing. Adjust R3 to midrange. Make sure the DB25 connector's wide side is up. Be sure to insert the DB25 connector thru the front panel of the case before soldering it to the pc board.

3) Break the mounting tabs off of the audio indicator. Trim the leads to about 1/2" and solder to the board. Mount the indicator to the board with silicone adhesive.

4) Insert the two IC's.

5) Drill holes in the case as shown on the drawings. Position the 9V battery clip and solder it to the pc board. Install the board in the case and screw the two case halves together. Install a 9V battery. Turn the interface on. It should make a short chirp sound.

6) Plug it onto your PB's RS232 connector. Set the PB for 2400 Baud. Connect the output jack to your recorder input and transmit some text from the PB to your recorder. Then switch the cable to the interface's input jack and tape

PART TWO: THE KENTUCKY POCKETBRAILLE

INTRODUCTION

This part of the manual provides complete instructions on how to build a Kentucky PocketBraille. It does not contain user operating procedures which may be found in the Kentucky PortaBraille/PocketBraille Users Guide.

The PocketBraille is simply a PortaBraille in a smaller case without the 20-cell braille display and large battery pack. The advantages over the PortaBraille are:

1) Lower parts cost (about $200 compared to $800).
2) Smaller size (about 8" x 5" x 1" compared to 8" x 6" x 2 1/2")
3) Less weight (about 1 lb. compared to 4 lbs.)

The PocketBraille consists of the PortaBraille's microprocessor board (and 256K RAM/Speech board) powered by two rechargeable standard 9V batteries. Since it uses the same firmware, all operations are identical to the PortaBraille (although those related to the braille display are not applicable). The internal batteries are recharged by connecting an external wall transformer. The braille keyboard, RS232 serial I/O connector, and parallel I/O connector, are all available for use just as in the PortaBraille. The PocketBraille can be assembled in about four hours. The same 256K RAM/Speech board is available for the PocketBraille to allow reading back of data. However, the software to drive the speech board is not available from us for free distribution at this time. Text-to-speech software must be purchased from other vendors. Contact us for current vendors of text-to-speech software.

The following pages contain detailed, step-by-step instructions on assembling each printed circuit board as well as case preparation and final assembly. All schematics and drawings are found in Appendix A. You will probably want to start by ordering parts from the parts list in Appendix B. This is a complete parts list for everything needed to construct a working unit. Appendix B also gives details on the availability of pc boards, kits of parts, and completely assembled and tested units. Observe the notes that indicate which parts are used only in the PortaBraille, only in the PocketBraille, or in both. The vendor and manufacturer code numbers refer to the listing in Appendix C. This list of vendors and manufacturers does not constitute an endorsement by the Kentucky Department for the Blind. It is provided simply as a convenience to builders and usually represents the vendors we have used. If you substitute manufacturers for a part specified, make sure the alternative part is equivalent.

mating connector. Some additional filing or cutting may be necessary if the case holes do not line up exactly with J1, J2, and J5. When all holes properly align, insert four #4 x 40 x 3/8" machine screws from the outside rear edge of the case and into J1 and J2. J1's holes are threaded and require no nuts. J2, however, will require two #4 x 40 nuts. There is barely enough clearance on J2 to position these two nuts. In fact, you will have to turn the nut and spacer on J2 such that a flat edge is parallel to the rear case surface in order to gain enough clearance to position these two nuts. Even then they may have to be wedged firmly into position. Tighten all four screws securely.

7) Tape two 9V nicad batteries together end to end with the bottoms of the batteries together. Snap a 9V battery connector clip on each battery. Route and tape down the wires from one battery along the wide side of the combined pack toward the other end. Cut all wires off about 2" beyond this end. Strip the ends and twist together the positive lead from one battery with the negative lead from the other battery. This will be the ground connection. The remaining positive lead will be V+ connection and the remaining negative lead will be the V- connection. Solder the wires to the corresponding pads on the microprocessor board.

8) Take a 3 1/2" x 1" wide piece of filament tape and fold it lengthwise back on itself creating a strip that is sticky on both sides. Press this onto the right inside surface of the case just to the right of the pc board. Then, press the battery assembly onto the exposed sticky portion of tape to secure it into the case. Be sure that the battery pack is resting on its narrow side, the taped wires from the front battery are on the left side, and the entire pack is centered between the front and rear edges of the case. The tape will help leave a .1" clearance between the battery pack and the right side wall to provide clearance for the top cover's molded rib when the top is closed. Be sure the battery pack does not interfere with the braille keyboard switch six.

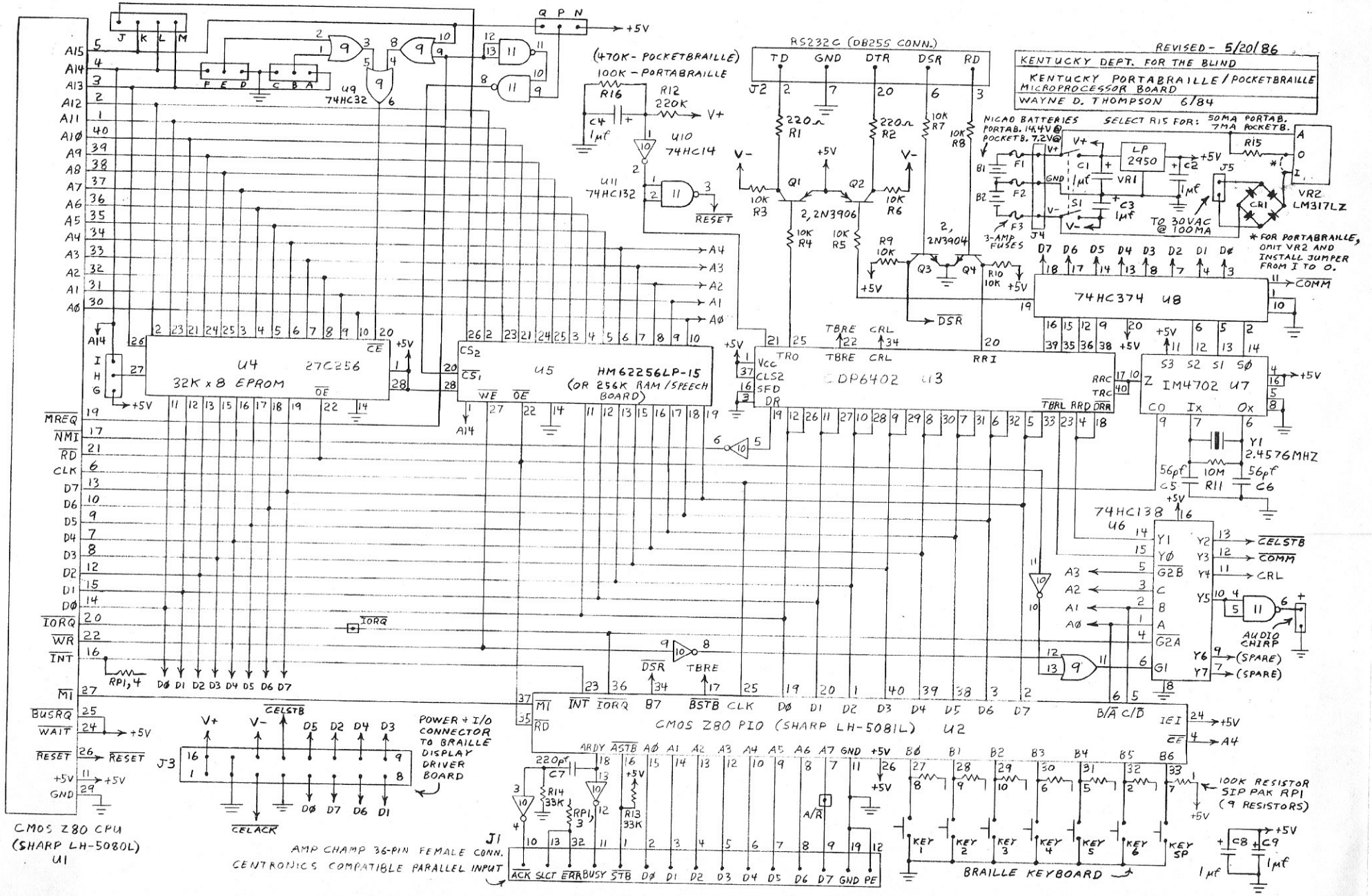
9) Plug the 30 VAC wall transformer into an AC outlet and the output end into J5. Charge the PocketBraille for 14 hours. If you think the batteries may already be fully or even partially charged, you may want to proceed with the next step before waiting for a battery charge.

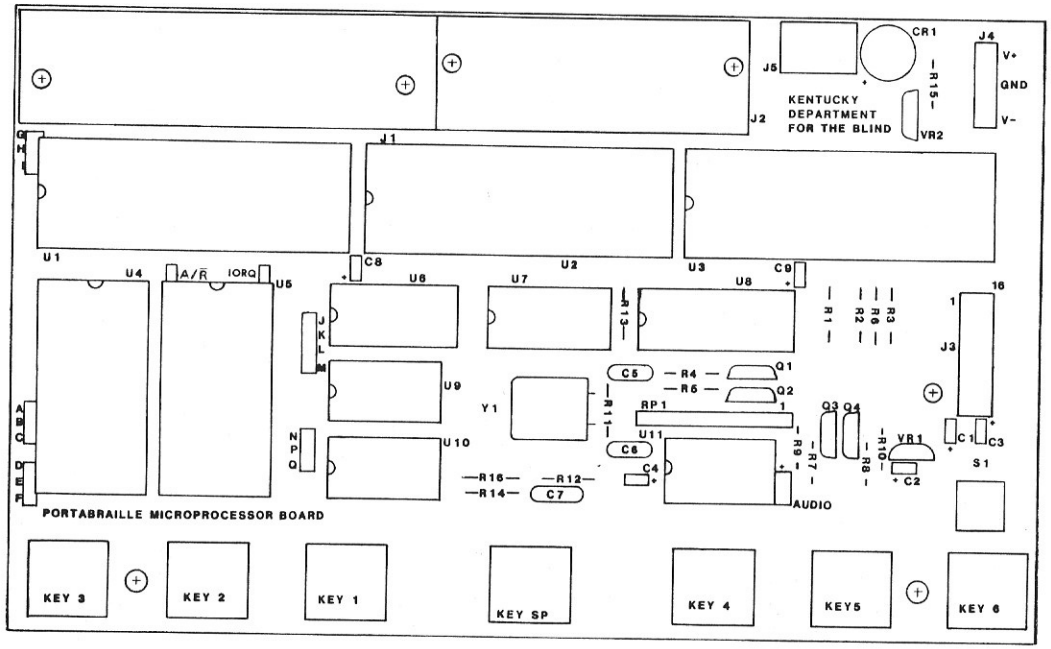
10) To test the Kentucky PocketBraille, turn on the power switch and enter commands and data as described in the Kentucky PortaBraille/PocketBraille Users Guide. Each keyboard entry should emit a faint chirp sound if you installed the audio indicator. To further verify operation, connect an output device to the RS232 port or

APPENDIX A: Drawings and Schematics

This appendix contains all the schematics, pc board layout drawings, case detail drawings, and photos for the Kentucky PortaBraille and the Kentucky PocketBraille. Reference is made to these drawings throughout the construction manual. Exact part specifications can be found by referencing the schematic designation on these drawings to the parts list in Appendix B.

(Note: The photographs still show the now obsolete 56K RAM board rather than the new 256K RAM/Speech Board but they should still be helpful.)


REVISED - 5/20/86
KENTUCKY DEPT. FOR THE BLIND
KENTUCKY PORTABRAILLE / POCKETBRAILLE MICROPROCESSOR BOARD
WAYNE D. THOMPSON 6/84
RS232C (DB25S CONN.)
TD GND DTR DSR RD
J2
(470K - POCKETBRAILLE)
100K - PORTABRAILLE
R16
R12 220K
C4 1µf
U10 74HC14
U11 74HC132
RESET
NICAD BATTERIES
PORTAB. 14.4V @
POCKETB. 7.2V @
SELECT R15 FOR: 50MA PORTAB. 7MA POCKETB.
LP 2950
VR1
VR2 LM317LZ
CR1
TO 30VAC @ 100MA
3-AMP FUSES
* FOR PORTABRAILLE, OMIT VR2 AND INSTALL JUMPER FROM I TO O.
74HC374 U8
COMM
U4 27C256
32K x 8 EPROM
U5 HM62256LP-15
(OR 256K RAM/SPEECH BOARD)
CDP6402 U3
S3 S2 S1 S0
Z IM4702 U7
Y1 2.4576MHZ
56pf C5
10M R11
56pf C6
74HC138 U6
CELSTB
COMM
CRL
AUDIO CHIRP
(SPARE)
(SPARE)
CMOS Z80 PIO (SHARP LH-5081L) U2
POWER + I/O CONNECTOR TO BRAILLE DISPLAY DRIVER BOARD
J3
CELACK
J1
AMP CHAMP 36-PIN FEMALE CONN.
CENTRONICS COMPATIBLE PARALLEL INPUT
100K RESISTOR SIP PAK RP1 (9 RESISTORS)
BRAILLE KEYBOARD
KEY 1
KEY 2
KEY 3
KEY 4
KEY 5
KEY 6
KEY SP
CMOS Z80 CPU (SHARP LH-5080L) U1



BOARD LAYOUT

NOTES:

1) INSTALL MEMORY CONFIGURATION STRAPS AS DESCRIBED ABOVE.
2) ON THE PORTABRAILLE, OMIT VR2 AND JUMPER ITS TWO UPPER PADS TOGETHER.
3) J3 IS REQUIRED ONLY ON THE PORTABRAILLE.
4) THE 56K OR 256K RAM/SPEECH BOARD, IF USED, PLUGS INTO SOCKET U5.
5) SELECT R15 TO SUPPLY 50MA ON THE PORTABRAILLE OR 7MA ON THE POCKETBRAILLE.

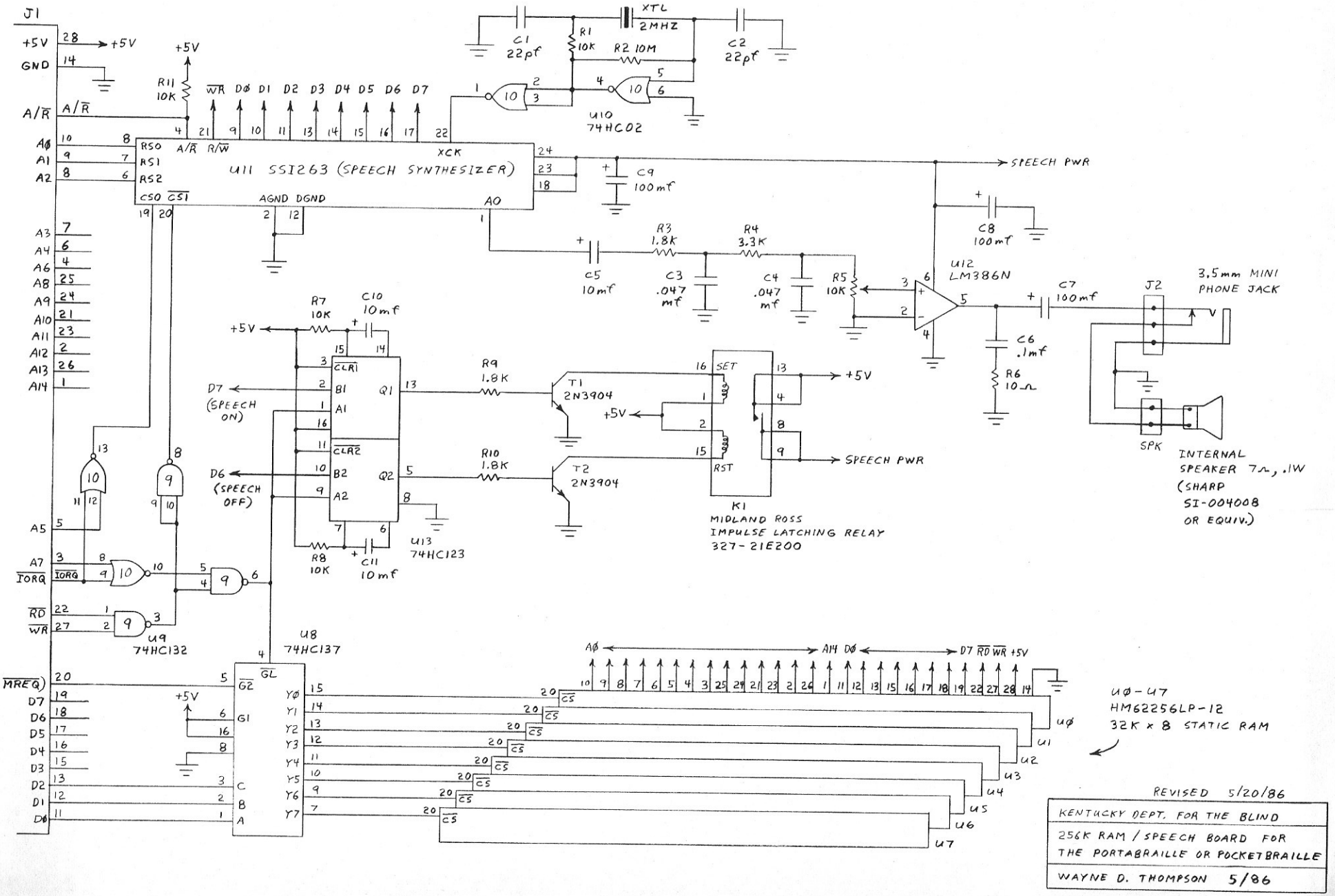
MEMORY CONFIGURATION STRAPS

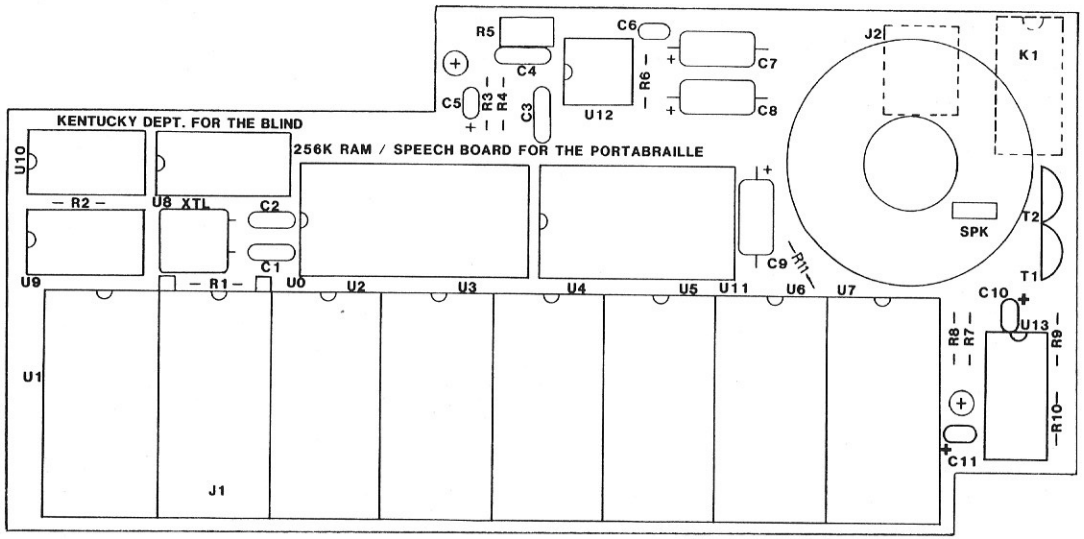
SINCE FIRMWARE IS NOW SUPPLIED ONLY IN 32K EPROMS, AND SINCE 32K RAMS ARE NOW AVAILABLE, ONLY ONE STRAPPING OPTION IS SUPPORTED:

BC, DE, HI, JM, PQ – 32K RAM CHIP OR 256K RAM/SPEECH BD.

KENTUCKY DEPT. FOR THE BLIND
PC BOARD LAYOUT FOR THE KENTUCKY PORTABRAILLE AND POCKETBRAILLE MICROPROCESSOR BOARD
WAYNE D. THOMPSON 7/85

REVISED – 5/20/86


J1
+5V
GND
A/R
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
IORQ
RD
WR
D0
D1
D2
D3
D4
D5
D6
D7
(A15 • MREQ)
R11 10K
C1 22pf
XTL 2MHZ
R1 10K
R2 10M
C2 22pf
U10 74HC02
U11 SSI263 (SPEECH SYNTHESIZER)
RS0 RS1 RS2
A/R R/W
XCK
CS0 CS1
AGND DGND
AO
C9 100mf
SPEECH PWR
C8 100mf
C5 10mf
R3 1.8K
R4 3.3K
C3 .047 mf
C4 .047 mf
R5 10K
U12 LM386N
C7 100mf
C6 .1mf
R6 10Ω
J2
3.5mm MINI PHONE JACK
SPK
INTERNAL SPEAKER 7Ω, .1W (SHARP SI-004008 OR EQUIV.)
R7 10K
C10 10mf
R8 10K
C11 10mf
U13 74HC123
CLR1
CLR2
B1
A1
Q1
B2
A2
Q2
D7 (SPEECH ON)
D6 (SPEECH OFF)
R9 1.8K
R10 1.8K
T1 2N3904
T2 2N3904
K1
MIDLAND ROSS IMPULSE LATCHING RELAY 327-21E200
SET
RST
U9 74HC132
U8 74HC137
G2 GL G1
C B A
Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7
A0 ... A14 D0 ... D7 RD WR +5V
U0 U1 U2 U3 U4 U5 U6 U7
U0-U7 HM62256LP-12 32K x 8 STATIC RAM
REVISED 5/20/86
KENTUCKY DEPT. FOR THE BLIND
256K RAM / SPEECH BOARD FOR THE PORTABRAILLE OR POCKETBRAILLE
WAYNE D. THOMPSON 5/86



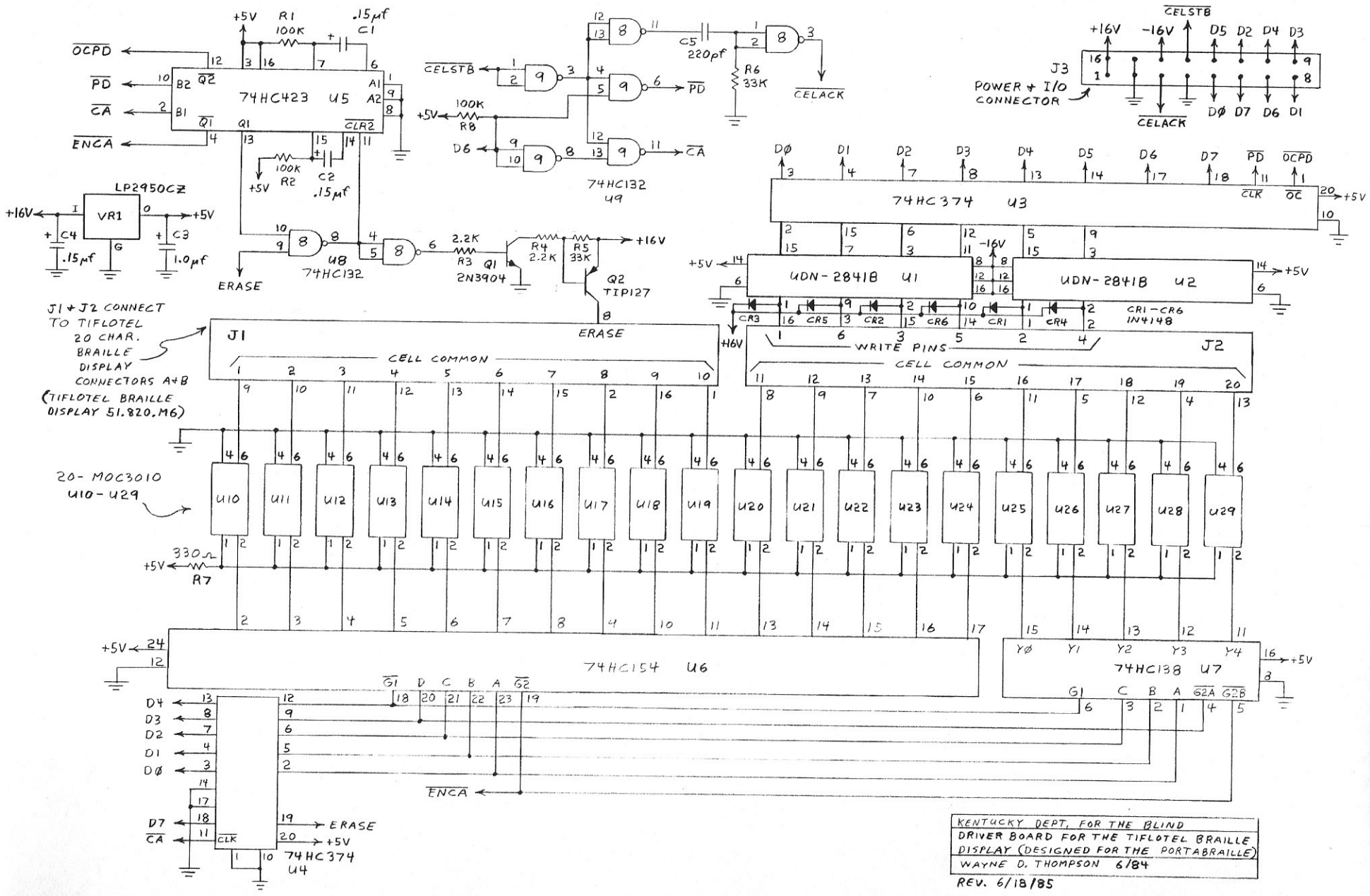
BOARD LAYOUT

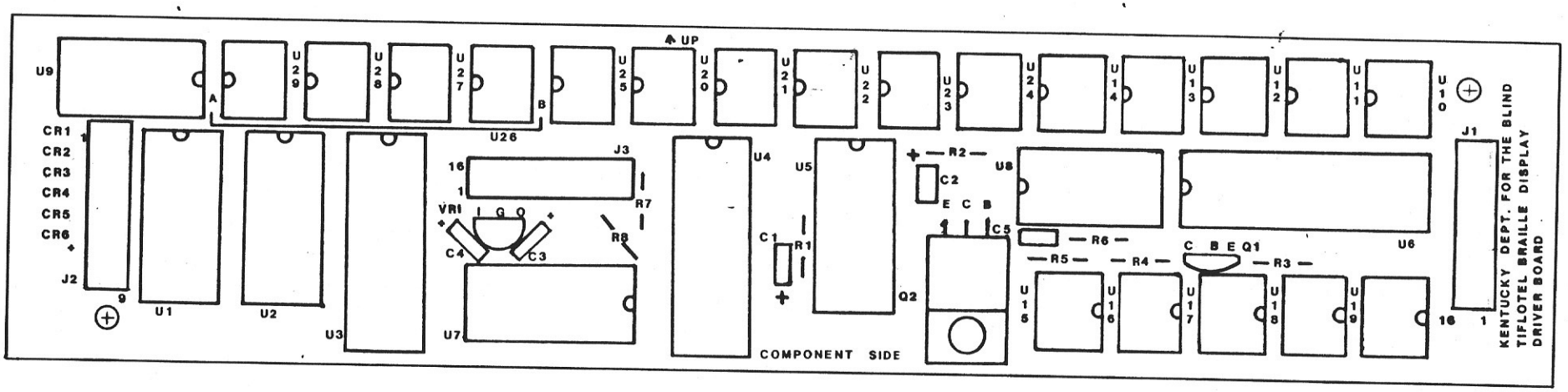
NOTES:

1) J2 AND K1 ARE MOUNTED ON THE BOTTOM SIDE OF THE BOARD.
2) PLACE A SMALL PIECE OF TAPE UNDER THE CRYSTAL AND SPEAKER BEFORE MOUNTING TO AVOID SHORTING OF PADS.
3) MOUNT SPEAKER BY COMPLETELY SEALING AROUND OUTER RIM WITH SILICONE ADHESIVE AFTER FIRST CONNECTING SPEAKER LEADS AND SOLDERING J2 AND K1.
4) U0 MUST BE INSTALLED. U1 THRU U7 ARE OPTIONAL BUT MUST BE INSTALLED IN ORDER.

REVISED 5/20/86

KENTUCKY DEPT. FOR THE BLIND
256K RAM/SPEECH BOARD FOR THE KENTUCKY PORTABRAILLE / POCKETBRAILLE
WAYNE D. THOMPSON 5/86


74HC423 U5
74HC132 U9
74HC132 U8
74HC374 U3
74HC374 U4
74HC154 U6
74HC138 U7
UDN-2841B U1
UDN-2841B U2
LP2950CZ
VR1
2N3904
TIP127
J1
J2
J3
CELL COMMON
WRITE PINS
CR1-CR6 IN4148
20- MOC3010 U10-U29
J1 + J2 CONNECT TO TIFLOTEL 20 CHAR. BRAILLE DISPLAY CONNECTORS A+B (TIFLOTEL BRAILLE DISPLAY 51.820.M6)
POWER + I/O CONNECTOR
ERASE
ENCA
CELSTB
CELACK
KENTUCKY DEPT. FOR THE BLIND
DRIVER BOARD FOR THE TIFLOTEL BRAILLE DISPLAY (DESIGNED FOR THE PORTABRAILLE)
WAYNE D. THOMPSON 6/84
REV. 6/18/85

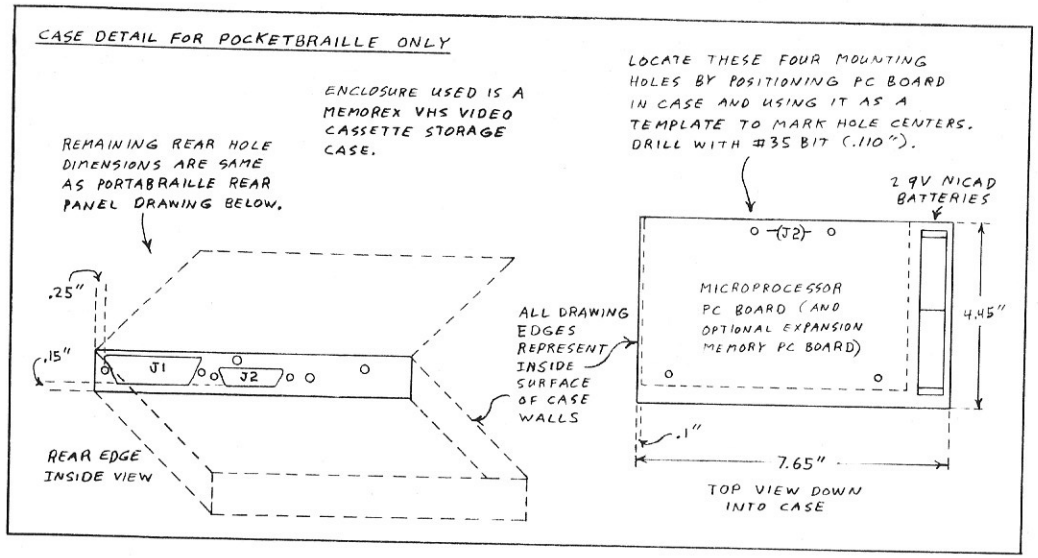


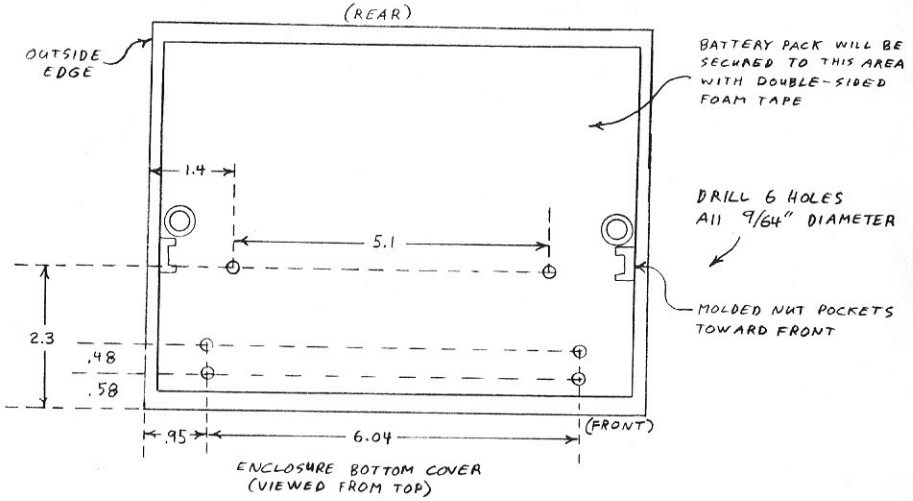
BOARD LAYOUT

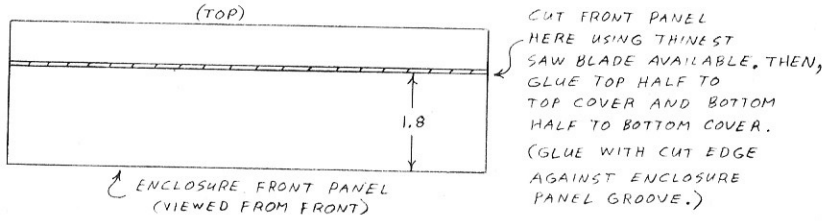
NOTES:

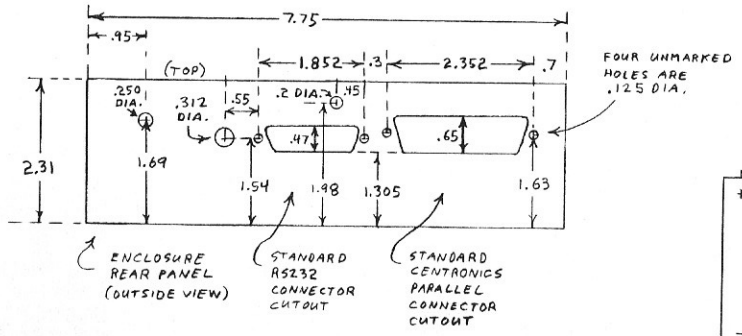
1) CONNECTORS J1 & J2 PLUG DIRECTLY ONTO THE TIFLOTEL DISPLAY CONNECTORS
2) PASS TWO SCREWS THROUGH THE HOLES ABOVE J1 AND BELOW J2 TO MOUNT THIS BOARD ON THE TIFLOTEL DISPLAY.
3) POWER AND I/O CONNECTIONS TO THE PORTABRAILLE MICROPROCESSOR BOARD (OR OTHER HOST SYSTEM) ARE MADE AT J3.
4) INSTALL JUMPER FROM PAD "A" TO PAD "B".

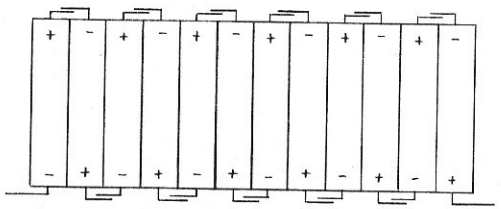
KENTUCKY DEPT. FOR THE BLIND
LAYOUT FOR DRIVER BOARD FOR THE TIFLOTEL BRAILLE DISPLAY
WAYNE D. THOMPSON 7/85


CASE DETAIL FOR POCKETBRAILLE ONLY
ENCLOSURE USED IS A MEMOREX VHS VIDEO CASSETTE STORAGE CASE.
REMAINING REAR HOLE DIMENSIONS ARE SAME AS PORTABRAILLE REAR PANEL DRAWING BELOW.
LOCATE THESE FOUR MOUNTING HOLES BY POSITIONING PC BOARD IN CASE AND USING IT AS A TEMPLATE TO MARK HOLE CENTERS. DRILL WITH #35 BIT (.110").
2.9V NICAD BATTERIES
.25"
.15"
J1
J2
(J2)
MICROPROCESSOR PC BOARD (AND OPTIONAL EXPANSION MEMORY PC BOARD)
4.45"
ALL DRAWING EDGES REPRESENT INSIDE SURFACE OF CASE WALLS
REAR EDGE INSIDE VIEW
.1"
7.65"
TOP VIEW DOWN INTO CASE

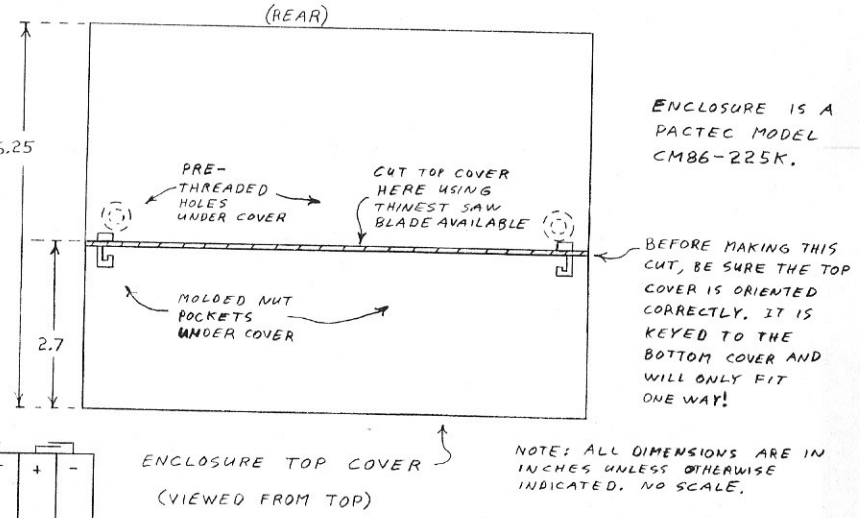



(TOP)
1.8
ENCLOSURE FRONT PANEL (VIEWED FROM FRONT)
CUT FRONT PANEL HERE USING THINEST SAW BLADE AVAILABLE. THEN, GLUE TOP HALF TO TOP COVER AND BOTTOM HALF TO BOTTOM COVER. (GLUE WITH CUT EDGE AGAINST ENCLOSURE PANEL GROOVE.)





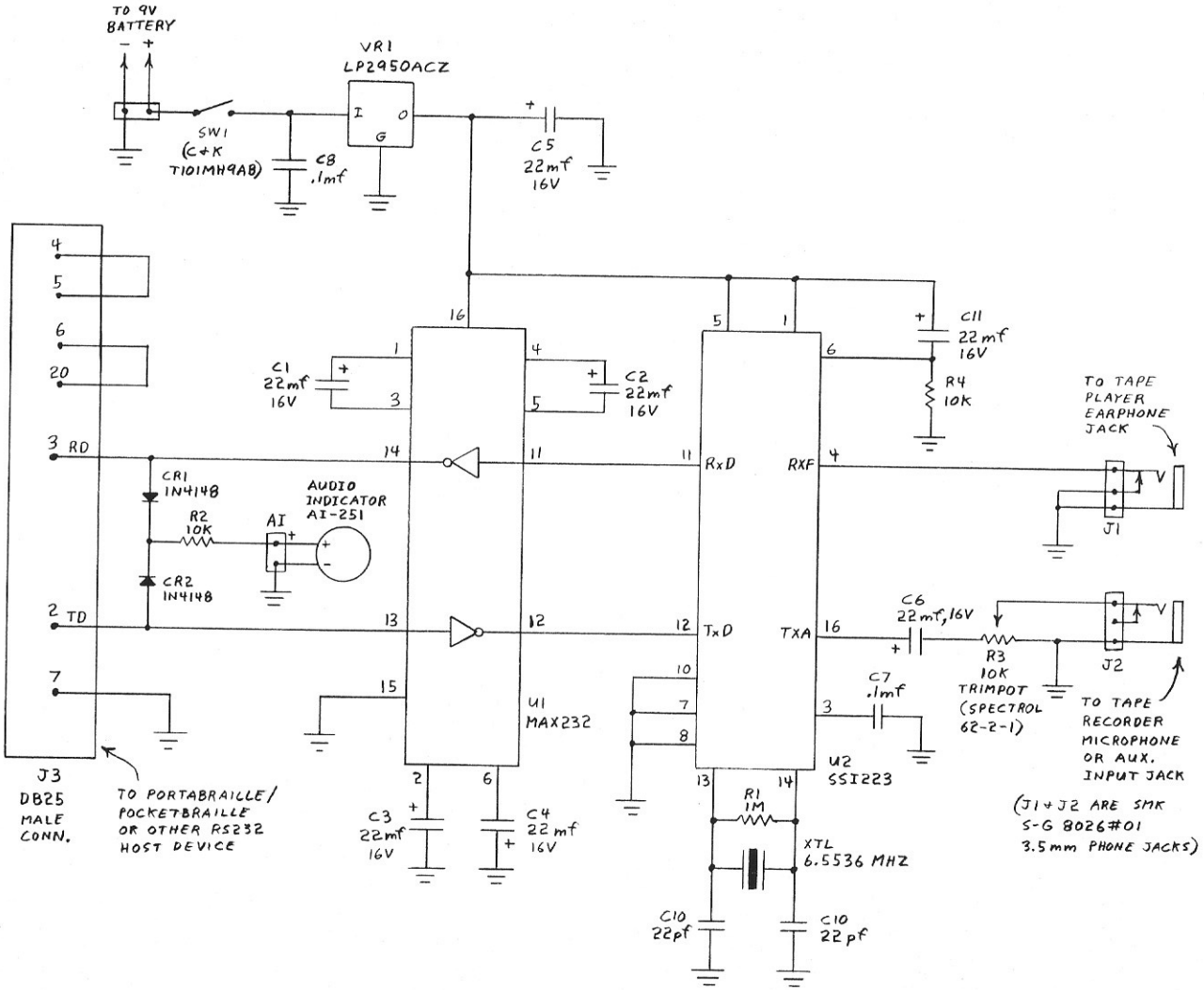
FOR PORTABRAILLE ONLY, TWO ASSEMBLIES OF 12 EACH SIZE AA NICAD CELLS (FAST CHARGE TYPE EVEREADY CF1ST OR EQUIV.) WITH SOLDER TABS. SEE CONSTRUCTION MANUAL FOR DETAILS ON ASSEMBLING BATTERIES.

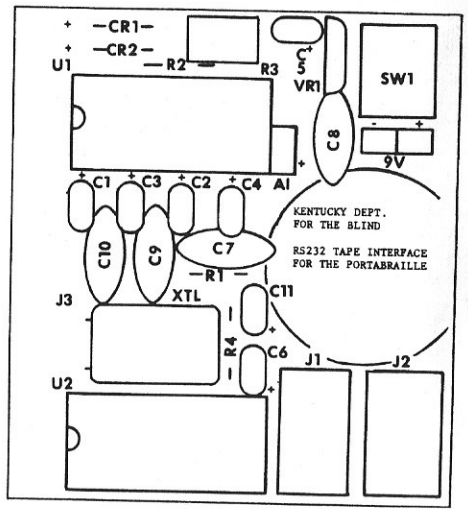

(REAR)
6.25
PRE-THREADED HOLES UNDER COVER
CUT TOP COVER HERE USING THINEST SAW BLADE AVAILABLE
MOLDED NUT POCKETS UNDER COVER
2.7
ENCLOSURE TOP COVER (VIEWED FROM TOP)
ENCLOSURE IS A PACTEC MODEL CM86-225K.
BEFORE MAKING THIS CUT, BE SURE THE TOP COVER IS ORIENTED CORRECTLY. IT IS KEYED TO THE BOTTOM COVER AND WILL ONLY FIT ONE WAY!

NOTE: ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED. NO SCALE.

KENTUCKY DEPT. FOR THE BLIND
KENTUCKY PORTABRAILLE AND POCKETBRAILLE CASE DETAILS
WAYNE D. THOMPSON 7/85

REVISED - 5/8/86



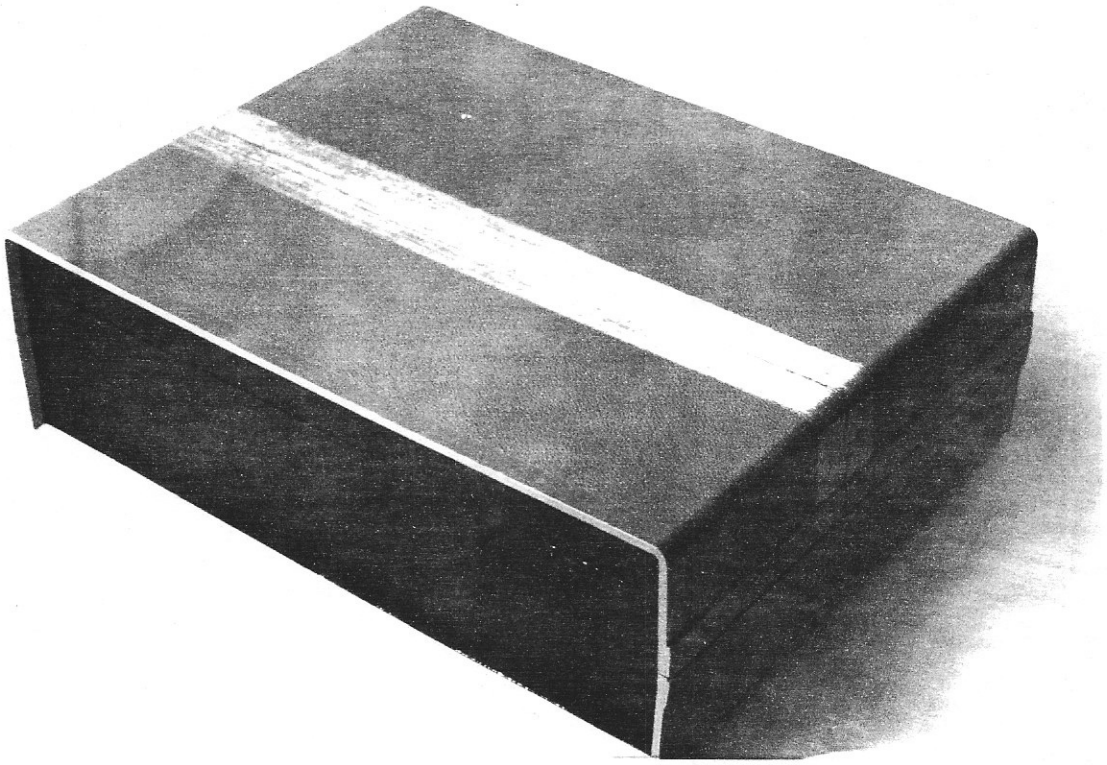


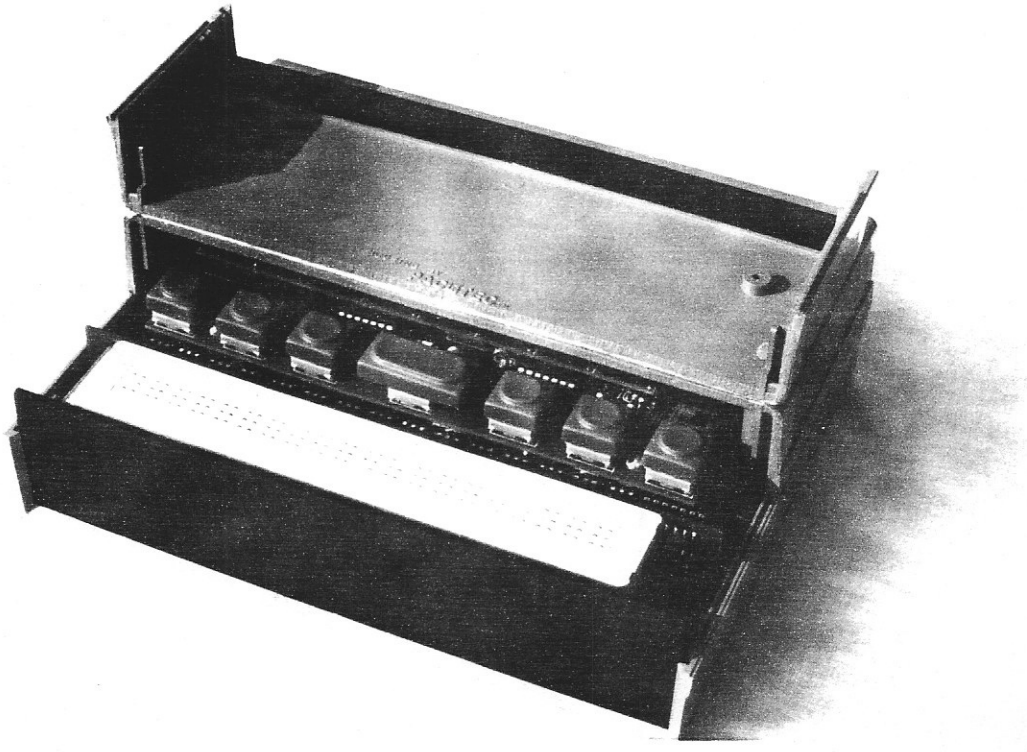
PC Board Layout

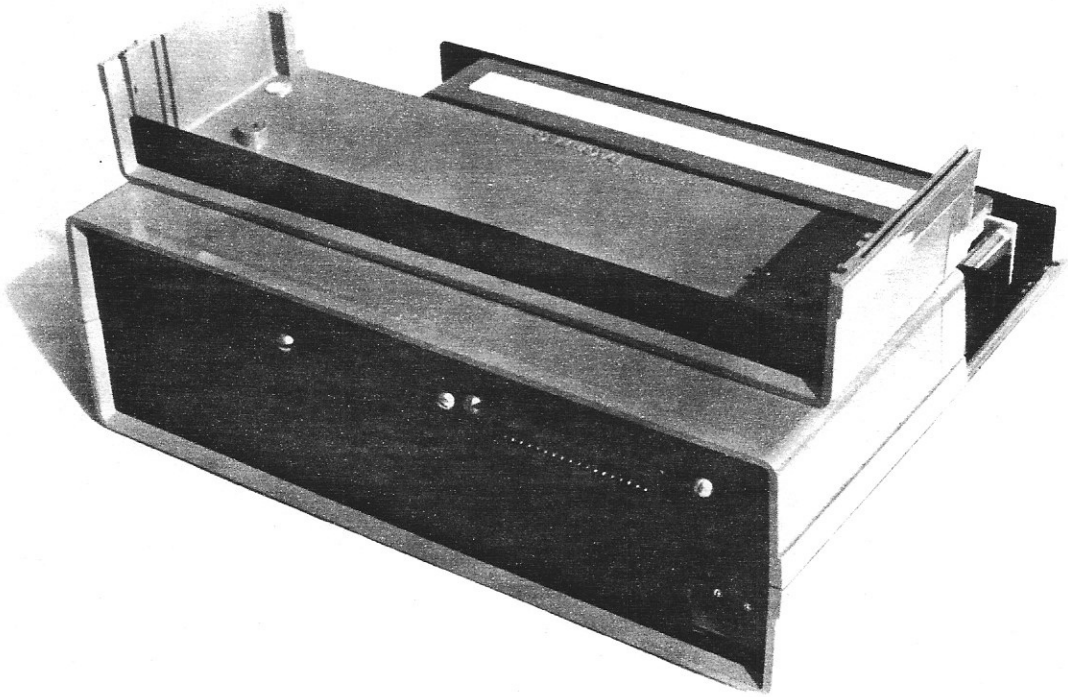
NOTES:

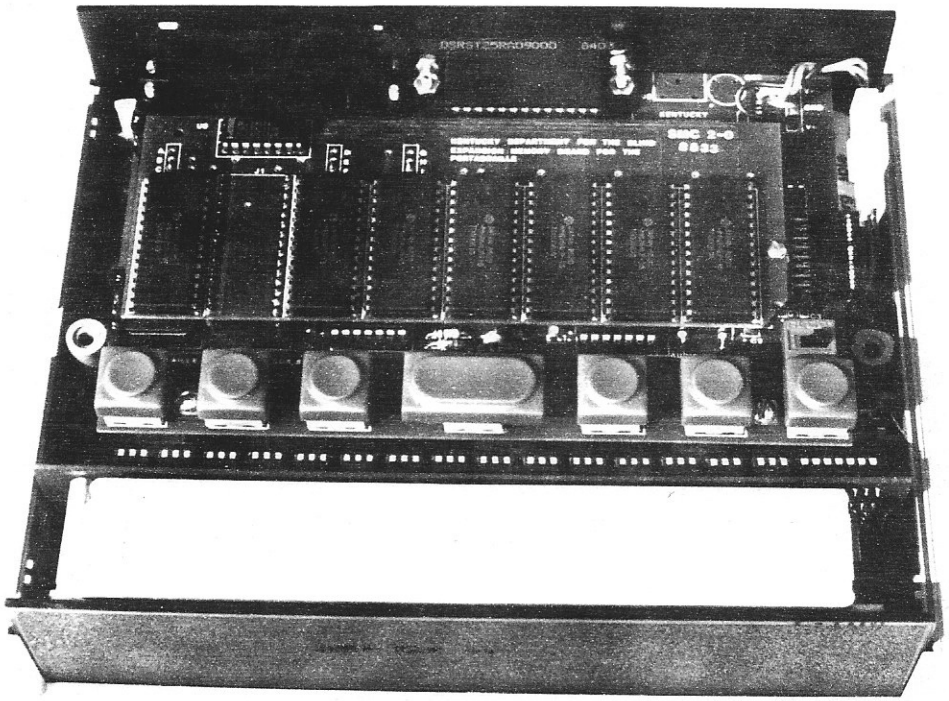
1) USE PACTEC HM-9VBK CASE TO HOUSE PC BOARD.
2) J3 MUST BE MOUNTED TO OUTSIDE OF FRONT PANEL. MOUNT CASE FRONT PANEL TO J3 BEFORE SOLDERING TO BOARD. PUNCH CENTER OF PANEL.
3) TO LOCATE CASE HOLES, POSITION COMPLETED BOARD IN TOP HALF OF CASE. MARK AND DRILL HOLES IN CASE SIDES FOR J1, J2, SW1, & R3. DRILL SMALL HOLE IN TOP SURFACE AT CENTER OF AUDIO INDICATOR.
4) ROUTE 9V BATTERY SNAP TO CASE BATTERY COMPARTMENT AND INSTALL 9V BATTERY.

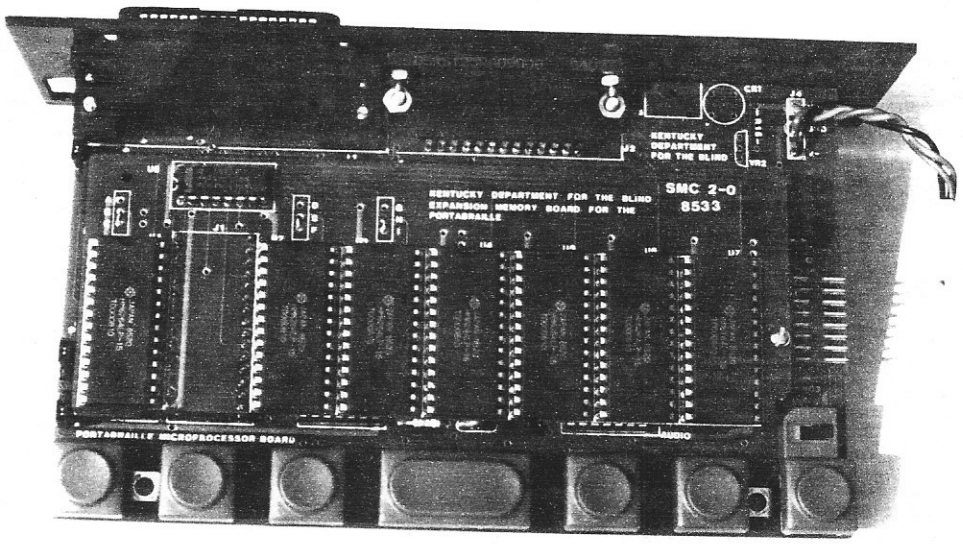
KENTUCKY DEPT. FOR THE BLIND
RS232/TAPE INTERFACE (0 TO 2400 BAUD) FOR THE PORTABRAILLE/POCKETBRAILLE
WAYNE D. THOMPSON 5/22/86

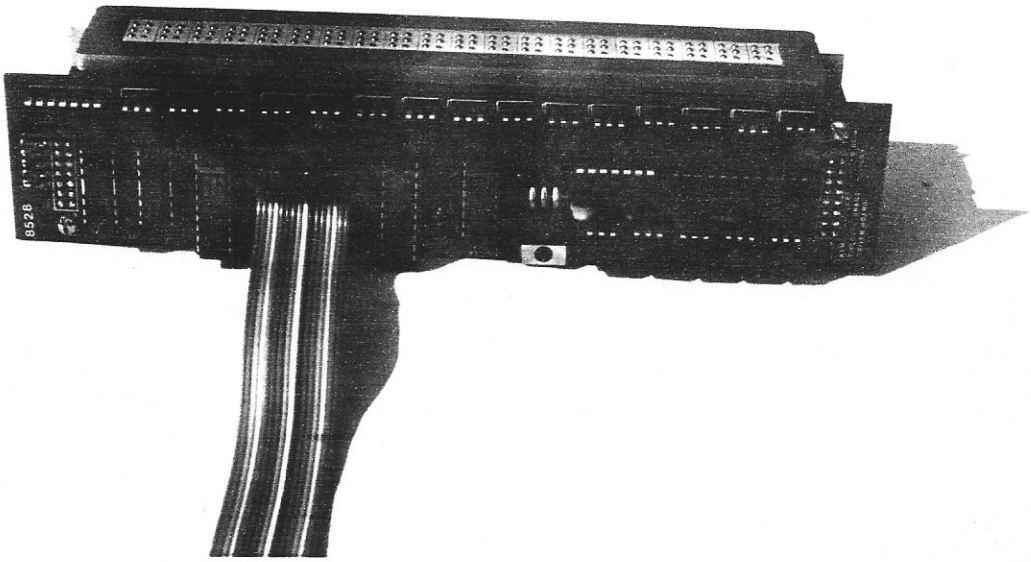


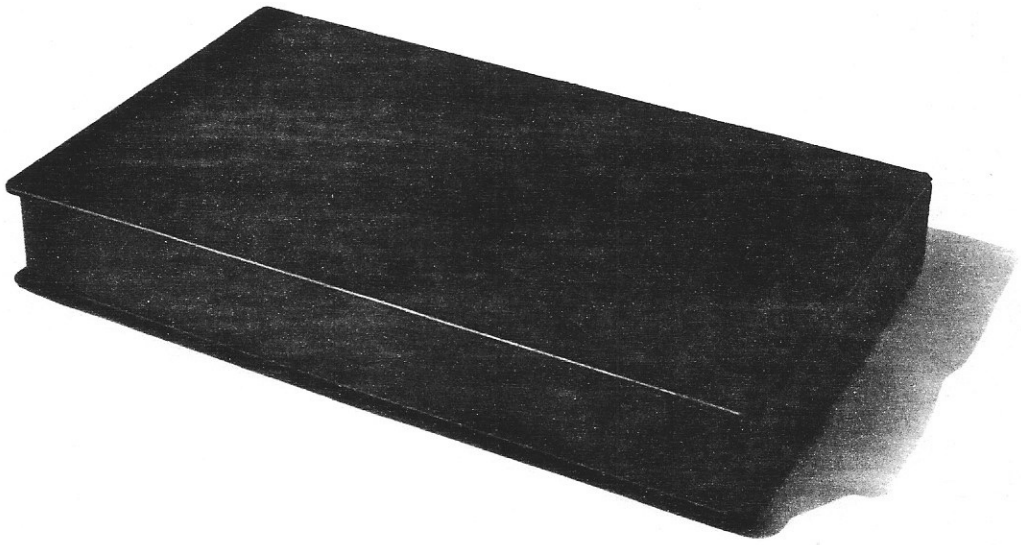


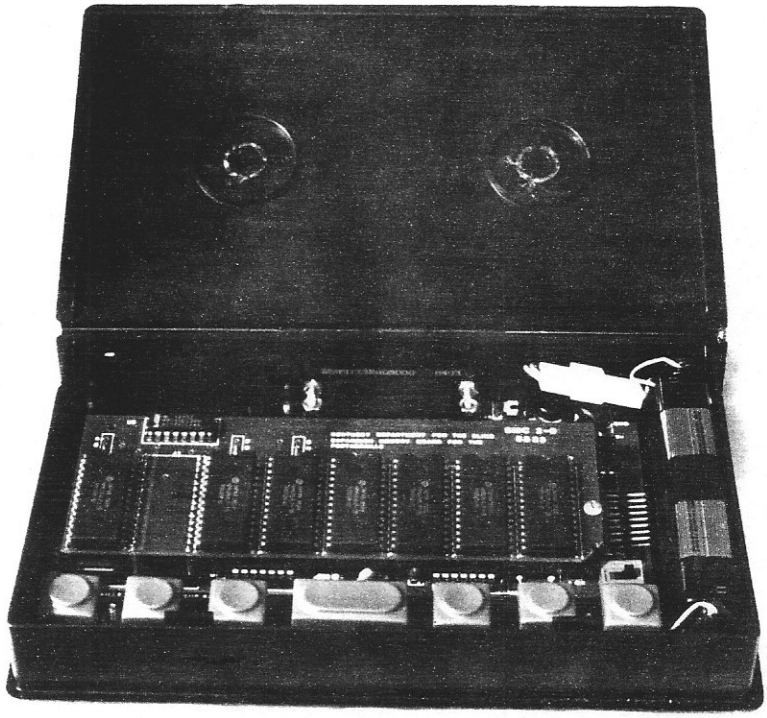


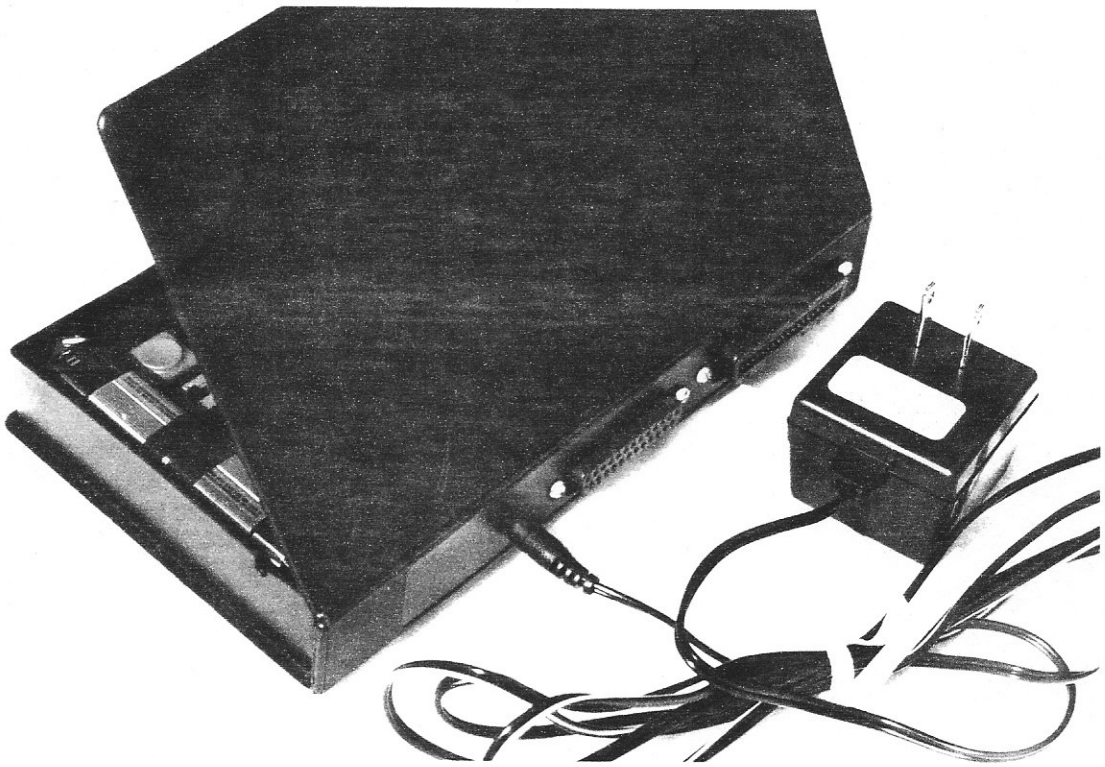


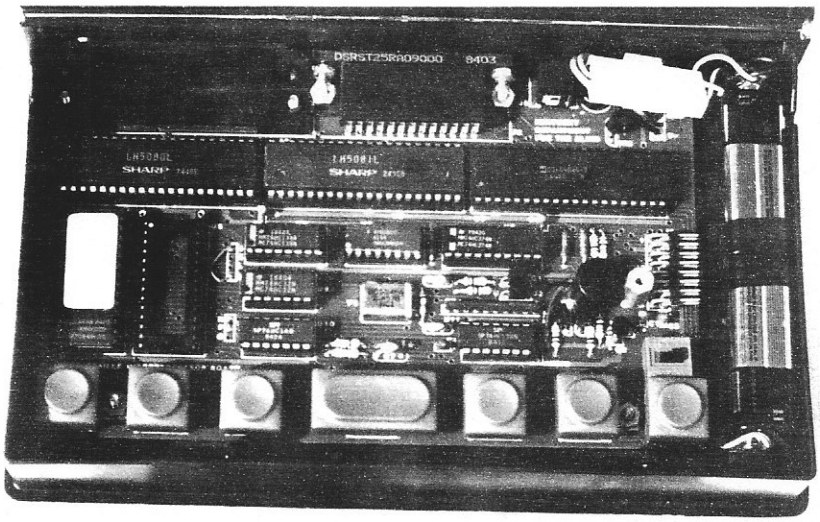

KENTUCKY DEPARTMENT FOR THE BLIND
EXPANSION MEMORY BOARD FOR THE PORTABRAILLE
SMC 2-0
8533
KENTUCKY DEPARTMENT FOR THE BLIND
PORTABRAILLE MICROPROCESSOR BOARD
AUDIO

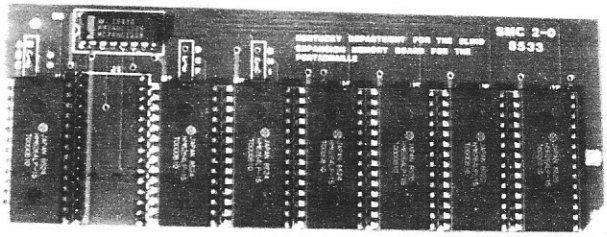

8528








DSRST25RA09000 8403
LH5080L
SHARP
LH5081L
SHARP



APPENDIX B: Parts List

This appendix lists all parts used in the Kentucky PortaBraille and the Kentucky PocketBraille.

The vendor and manufacturer code numbers refer to the listing in Appendix C. This list of vendors and manufacturers does not constitute an endorsement by the Kentucky Department for the Blind. It is provided simply as a convenience to builders and usually represents the vendors we have used. You may want to shop around to get the best prices, especially on IC's. If you substitute manufacturers for a part specified , make sure the alternate part is equivalent both electrically and mechanically. Otherwise, it may not work properly or fit properly into the PortaBraille or PocketBraille case.

If you are building the PortaBraille, all parts in this Appendix are required unless otherwise noted. If you are building the PocketBraille, only those parts listed under the section for Microprocessor Board and 256K RAM/Speech Board are required except as otherwise noted in the other sections.

Printed circuit boards for both the PortaBraille and the PocketBraille are currently manufactured and available from Southland Manufacturing Company (vendor #16 in Appendix C). Southland has generously volunteered to make these boards available at their cost. The current prices are:

Microprocessor Board - $7
Braille Display Driver Board - $6
256K RAM/Speech Board - $7
(Prepunched rear panel for PortaBraille case - $3)
Tape Interface Board - $6

Of course, these prices are subject to change. Southland also intends to offer, at their cost, completely assembled and tested PortaBrailles and PocketBrailles beginning sometime in 1986. A complete kit of parts may also become available from Southland, again, at their cost. Contact them for pricing and availability of all these items.

Many other companies and volunteer groups have expressed an interest in marketing the PortaBraille and PocketBraille. Contact the Kentucky Department for the Blind for the latest information on vendors of completed units and parts kits.

8	-	-	1	#4 Internal Tooth Lockwasher
2	2	- (*7)	28	SC-1P4-GT Lead Sockets

Notes:

(*1) - May substitute 256K RAM/Speech Board.
(*2) - For PortaBraille, omit this regulator and short the two upper pads together (O and I).
(*3) - Required only on PocketBrailles without 256K RAM/Speech Board.
(*4) - Required only on the PortaBraille.
(*5) - Firmware will be burned into your EPROM, free, by Vendor #5.
(*6) - R16 is 100K for PortaBraille; 470K for PocketBraille.
(*7) - Optional. Used only on the PocketBraille to raise the height of the keyboard. Reference the section on constructing the microprocessor board.
(*8) - R15 is 120 ohms for the PocketBraille; O ohms for the PortaBraille.

PARTS LIST FOR THE BRAILLE DISPLAY AND DRIVER BOARD

VENDOR	MFGR.	SCHEMATIC DESIGNATION	QT.	PART # AND/OR DESCRIPTION
9	14	U1,U2	2	UDN-2841B Quad Drivers
4	6	U3,U4	2	74HC374 IC
6	6	U5	1	74HC423 IC
4	6	U6	1	74HC154 IC
4	6	U7	1	74HC138 IC
4	6	U8,U9	2	74HC132 IC
3	15	U10-U29	20	MOC3010 Optical Bilateral Switch
9	-	R1,R2,R8	3	100K, 1/4 W, 5% Resistor
9	-	R3,R4	2	2.2K, 1/4 W, 5% Resistor
9	-	R5,R6	2	33K, 1/4 W, 5% Resistor
9	-	R7	1	330 ohm, 1/4 W, 5% Resistor
4	5	C1,C2,C4	3	P2054 .15 mf, 35V Tantalum Capacitor
4	5	C3	1	P2059 1mf, 35V Tantalum Capacitor
4	5	C5	1	P4104 220pf, Disc Capacitor
4	-	CR1-CR6	6	1N4148 Diodes
4	-	Q1	1	2N3904 NPN Transistor
4	-	Q2	1	TIP127PNP Transistor
9	6	VR1	1	LP2950ACZ +5V Micropower Reg.
2	2	J3	1	TSW-108-07-T-D Terminal Strip
2	2	(J3)	1	IDSD-08-D-5 Ribbon Cable Connector
2	2	J1,J2	2	SSW-108-04-T-D Socket Strip
6	13	(U10-U29)	20	C840602 6-pin, Low Profile DIP Sockets
6	13	(U6)	1	C842403 24-pin, Low Profile DIP Sockets
4	13	(U3,U4)	2	C8920 20-pin, Low Profile DIP Sockets
4	13	(U1,U2,U5,U7)	4	C8916 16-in, Low Profile DIP Sockets
4	13	(U8,U9)	2	C8914 14-pin, Low Profile DIP Sockets
16	16	-	1	PortaBraille Braille Display Driver PCBoard
9	-	-	2	#4 x 40 x 1" Hex Threaded Spacer
8	-	-	4	#4 x 40 x 3/8" Machine Screw
8	-	-	2	#4 x 40 Nuts
8	-	-	2	#4 Internal Tooth Lockwashers
11,16	11	-	1	51.820.M6 20-Cell Braille Display

PARTS LIST FOR TAPE INTERFACE BOARD

VENDOR	MFGR.	SCHEMATIC DESIGNATION	QTY.	PART # AND/OR DESCRIPTION
17	35	U1	1	MAX232 Dual RS232 Driver IC
17	29	U2	1	SSI223 FSK Modem IC
4	-	CR1,CR2	2	1N4148 Diodes
9	6	VR1	1	LP2950ACZ +5V Micropower Regulator
10	-	XTL	1	6.5536 MHZ Crystal (HC-18 Case)
4	5	C1-C6,C11	7	P2040 22 mf, 16V Tantalum Capacitor
4	5	C7,C8	2	P4311 .1 mf Disc. Capacitor
4	5	C9,C10	2	P4004 22 pf Disc Capacitor
9	-	R1	1	1M, 1/4 W, 5% Resistor
9	-	R2,R4	2	10K, 1/4 W, 5% Resistor
6	30	R3	1	62-2-1 10K Trimpot
20	34	J1,J2	2	S-G 8026#01 3.5 mm Phone Jack
4	-	J3	1	1S25P-ND 25-Pin Male RS232 Conn.
14	31	-	1	AI-251 Audio Indicator
4	-	-	1	470C 9V Battery Snap
6	36	SW1	1	T101MH9AB SPDT R.A. PC Mount Switch
16	16	-	1	Tape Interface Printed Circuit Board
12	23	-	1	HM-9VBK Case
8	-	-	1	9V Battery
8	-	-	2	#4 x 40 x 1/4" Machine Screw
8	-	-	2	#4 x 40 Nut

VENDOR ADDRESSES AND PHONE NUMBERS

1. Sharp Electronics Corp.
   Electronics Components Group
   10 Sharp Plaza
   Paramus, N.J. 07652
   201-265-5600

2. Samtec, Inc.
   P.O. Box 1147
   New Albany, IN 47150
   812-944-6733

3. Jameco Electronics
   1355 Shoreway Road
   Belmont, CA 94002
   415-592-8097

4. Digi-Key Corporation
   701 Brooks Avenue, South
   P.O. Box 677
   Thief River Falls, MN 56701
   800-344-4539

5. Kentucky Department for the Blind
   427 Versailles Road
   Frankfort, KY 40601
   502-564-4754

6. Newark Electronics
   1313 Lyndon Lane
   Louisville, KY 40222
   502-423-0280

7. *Marcum Switches, Inc.
   67 Albany Street
   Cazenovia, N.Y. 13035

8. Local Hardware or Department Store

9. Local Electronics Distributor

11. Tiflotel
    24032 Calolziocorte
    Bergamo
    Italy
    Tel. (0341) 642.292

12. Prehler Electronics, Inc.
    2300 N. Kilbourn Avenue
    Chicago, IL 60639
    312-384-6100

13. Local Radio Shack Store

14. Projects Unlimited, Inc.
    3680 Wyse Road
    Dayton, Ohio 45414
    513-890-1918

15. Videotape Products, Inc.
    320 N. Madison Avenue
    Los Angeles, CA 90004
    213-664-1144

16. Southland Manufacturing
    680 Bizzell Drive
    Lexington, KY 40510
    606-253-3066

17. Hall Mark Electronics
    4275 W. 96th St.
    Indianapolis, IN 46268
    317-872-8875

18. Diplomat Electronics

    Chicago, Illinois
    312-595-1000

19. Reptron
    404 E. Wilson Bridge Rd.
    Suite A
    Worthington, Ohio 43085
    614-436-6675

20. Waco Electornics, Inc.
    4900 Monaco Street
    Commerce City, Colorado 80022
    800-525-0811

APPENDIX D: BATTERY USAGE

The battery pack in the PortaBraille consists of 24 size AA Nickel-Cadmium cells. The manner in which you use your batteries can greatly affect their life and charge capacity. Try to adhere to the guidelines below to achieve maximum performance from your PortaBraille's battery pack.

The length of time that a full charge will last on the Portbraille depends almost entirely on how much the braille display is used. In test mode, which displays a new line every four seconds, a full charge will last about ten hours. Typical usage, however, would not exercise the display that heavily so you could probably count on several days of normal operation. If the display was used very little, the PortaBraille could be left on for several weeks and still maintain its memory and be operational (although the batteries might be too weak to drive the display). Whenever the PortaBraille is not actively processing data, it automatically enters a power-down stand-by mode and consumes very little power while awaiting your next command or more incoming data.

Note that unused Ni-Cad batteries still lose about 1% of their charge per day at room temperature due to self discharge.

The procedure for obtaining "optimum" performance and lifetime from the battery pack is this:

1) Charge the batteries using the wall transformer for 14 hours with the PortaBraille turned off.

2) Remove the wall adapter and use the PortaBraille only on battery power until the batteries are fully discharged (detected by weak dot movement on the braille display).

3) Repeat the above two steps.

Of course, this procedure is fairly restrictive and some permissible deviations will be listed shortly. The above procedure is given simply to inform you of the "ideal" recharge/discharge cycle as recommended by Ni-Cad battery manufacturers.

The following items are additional suggestions and some acceptable deviations to the "ideal" procedure given above. These deviations are useful and sometimes unavoidable in practical situations.

1) Continuous charging will not harm the batteries but may reduce their capacity for charge.

Kentucky Department for the Blind

427 VERSAILLES ROAD, FRANKFORT, KENTUCKY 40601 (502) 564-4754

CHARLES W. McDOWELL, Executive Director

M E M O R A N D U M

TO: All Holders of the Construction Manual for the Kentucky PortaBraille/PocketBraille

FROM: Kentucky Department for the Blind
Technical Services Unit
Wayne Thompson

DATE: September 2 ,1986

This August 1986 revision to the Construction Manual for the Kentucky PortaBraille/PocketBraille is being made to reflect various improvements and corrections to the schematics and printed circuit boards within the PortaBraille/PocketBraille. Most of the changes are related to correcting the speech power-down circuitry and revising input/output circuits to accommodate interrupt driven speech.

Only some of the pages in the manual have been affected. To keep your manual current, please use the attached new pages to replace the corresponding old pages in your manual. (Note that the original one page schematic for the microprocessor board now consists of two pages.) All other pages in your manual are still correct and should be left in place.

WT/paa

An equal opportunity employer, M/F & H

CONSTRUCTION MANUAL
for the
KENTUCKY PORTABRAILLE
and the
KENTUCKY POCKETBRAILLE

KENTUCKY DEPARTMENT FOR THE BLIND
TECHNICAL SERVICES UNIT
427 VERSAILLES ROAD
FRANKFORT, KENTUCKY 40601
(502) 564-4754

WAYNE D. THOMPSON, P.E.
August, 1985

(Revised - May, 1986)
(Revised - August, 1986)

"MICROPROCESSOR BOARD FOR THE KENTUCKY PORTABRAILLE AND THE KENTUCKY POCKETBRAILLE"
(and Optional 256K RAM/Speech Board)

General Description

This pc board and circuit was designed by the Kentucky Department for the Blind for use in the Kentucky PortaBraille. It is a CMOS Z80 based design with on-board firmware to control all functions of the PortaBraille or PocketBraille. The circuit is implemented entirely with high speed CMOS technology to permit battery operation. Features include up to 256K of RAM; 32K EPROM; RS232C I/O connector; parallel centronics compatible input or output connector; 7-key braille keyboard; and an output connector designed to connect directly to the Kentucky Driver Board for the Tiflotel Braille Display. Many parameters and modes of operation may be selected by the user through commands entered on the braille keyboard. Operating procedures are covered in the Kentucky PortaBraille/PocketBraille Users Guide.

Board Assembly

This microprocessor board is easy to assemble. When complete, it mounts inside the PortaBraille or PocketBraille case. Perform the following steps to assemble the board:

1) Inspect the pc board carefully for any obvious flaws. It is much easier to spot an imperfection in a trace now than later when all the parts are mounted. All the following parts are mounted on the component side, that is, the side that has the printed component designations. Reference the drawings in Appendix A throughout the following steps.

2) Solder low profile sockets in the indicated positions for all integrated circuits. If pin 1 is indicated on the sockets, be sure to orient them correctly as shown on the board surface and attached drawings.

3) Socket U5 may contain a 32K x 8 CMOS RAM or, it can be used as the connector to a piggybacked 256K RAM/Speech board.

4) Solder all resistors and capacitors in the positions indicated. Observe proper orientation on polarized components. VR2 is required only if you are building a PocketBraille. For the PortaBraille, omit VR2 and short the two upper pads of VR2 together (I and O).

5) Lay crystal Y1 flat against the board and solder to the pads indicated. Place a piece of insulating tape under Y1.

If your cabinet back panel does not yet have the holes made as shown in the drawings, then you will have to postpone the rest of this step until the back panel is prepared. Also, if you are building a PocketBraille omit the rest of this step. Otherwise, mount the back panel to the microprocessor board by inserting J1 and J2 through their respective holes and tightening down with four #4 x 40 x 3/8" screws inserted from the outside of the back panel in toward the connectors. J1's holes are threaded and require no nuts. J2, however, will require two 4 x 40 nuts. There is barely enough clearance on J2 to position these two nuts. In fact, you will have to turn the nut and hex spacer on J2 such that a flat edge is parallel to the rear panel in order to gain enough clearance to position these two nuts. Even then they may have to be wedged firmly into position. Tighten all four screws securely.

12) Solder one side of each in-line fuse holder assembly to P4. Twist the wires a few times to group the three wires together. This forms the power input cable and will later connect to the battery pack.

13) Install and solder keyswitches Key 1 through Key 6 and Key SP as shown. Key SP is the space key and is wider than the other six. Due to the mounting pins on the keyswitches, they can only be inserted one way. Make sure each key is firmly against the board surface before soldering the pins.

    If you are building a PocketBraille, you may prefer the keys to be mounted higher (flush with the inside top cover). If so, insert and solder the 28 lead sockets specified in the parts list, 4 per keyswitch at each switch location. Then mount and solder the keyswitches on these raised lead sockets. Solder the two metal contact pins; epoxy the two plastic mounting pins. Some users might find this raised keyboard preferable to the somewhat recessed location obtained without the lead sockets. Of course, if you mount the board in another case of your own design or choosing, then the keyboard might not be recessed and these lead sockets would not be needed.

14) Insert all integrated circuits in their corresponding sockets observing proper orientation. Handle chips in a static-free environment since they are CMOS. (The firmware, to be placed in EPROM U4, is available from the Kentucky Department for the Blind for free by sending us your EPROM for programming). If you are not installing the 256K RAM/Speech board, then the microprocessor board is now complete. Otherwise, complete the remaining steps below.

mating connector. Some additional filing or cutting may be necessary if the case holes do not line up exactly with J1, J2, and J5. When all holes properly align, insert four #4 x 40 x 3/8" machine screws from the outside rear edge of the case and into J1 and J2. J1's holes are threaded and require no nuts. J2, however, will require two #4 x 40 nuts. There is barely enough clearance on J2 to position these two nuts. In fact, you will have to turn the nut and spacer on J2 such that a flat edge is parallel to the rear case surface in order to gain enough clearance to position these two nuts. Even then they may have to be wedged firmly into position. Tighten all four screws securely.

7) Tape two 9V nicad batteries together end to end with the bottoms of the batteries together. Snap a 9V battery connector clip on each battery. Route and tape down the wires from one battery along the wide side of the combined pack toward the other end. Cut all wires off about 2" beyond this end. Connect the two positive leads to pin 1 of connector P4 (BATT+). Connect the two negative leads to pin 2 of connector P4 (GND). This will place the two batteries in parallel as a +9V supply with twice the current capacity as one battery would have.

8) Take a 3 1/2" x 1" wide piece of filament tape and fold it lengthwise back on itself creating a strip that is sticky on both sides. Press this onto the right inside surface of the case just to the right of the pc board. Then, press the battery assembly onto the exposed sticky portion of tape to secure it into the case. Be sure that the battery pack is resting on its narrow side, the taped wires from the front battery are on the left side, and the entire pack is centered between the front and rear edges of the case. The tape will help leave a .1" clearance between the battery pack and the right side wall to provide clearance for the top cover's molded rib when the top is closed. Be sure the battery pack does not interfere with the braille keyboard switch six.

9) Plug the 30 VAC wall transformer into an AC outlet and the output end into J5. Charge the PocketBraille for 14 hours. If you think the batteries may already be fully or even partially charged, you may want to proceed with the next step before waiting for a battery charge.

10) To test the Kentucky PocketBraille, turn on the power switch and enter commands and data as described in the Kentucky PortaBraille/PocketBraille Users Guide. To further verify operation, connect an output device to the RS232 port or parallel port and try transferring data between the two devices. Remember to match communication parameters. Also try the various speech commands if you have installed the 256K RAM/Speech board. If the

APPENDIX B: Parts List

This appendix lists all parts used in the Kentucky PortaBraille and the Kentucky PocketBraille.

The vendor and manufacturer code numbers refer to the listing in Appendix C. This list of vendors and manufacturers does not constitute an endorsement by the Kentucky Department for the Blind. It is provided simply as a convenience to builders and usually represents the vendors we have used. You may want to shop around to get the best prices, especially on IC's. If you substitute manufacturers for a part specified , make sure the alternate part is equivalent both electrically and mechanically. Otherwise, it may not work properly or fit properly into the PortaBraille or PocketBraille case.

If you are building the PortaBraille, all parts in this Appendix are required unless otherwise noted. If you are building the PocketBraille, only those parts listed under the section for Microprocessor Board and 256K RAM/Speech Board are required except as otherwise noted in the other sections.

Printed circuit boards for both the PortaBraille and the PocketBraille are currently manufactured and available from Southland Manufacturing Company (vendor #16 in Appendix C). Southland has generously volunteered to make these boards available at their cost. The current prices are:

Microprocessor Board - $7
Braille Display Driver Board - $6
256K RAM/Speech Board - $7
(Prepunched rear panel for PortaBraille case - $3)
Tape Interface Board - $6

Of course, these prices are subject to change. Southland also intends to offer, at their cost, completely assembled and tested PortaBrailles and PocketBrailles beginning sometime in 1986. A complete kit of parts may also become available from Southland, again, at their cost. Contact them for pricing and availability of all these items.

Many other companies and volunteer groups have expressed an interest in marketing the PortaBraille and PocketBraille. Contact the Kentucky Department for the Blind for the latest information on vendors of completed units and parts kits.

8	-	-	5	#4 x 40 x 3/8" Machine Screws
8	-	-	1	#4 x 40 Nuts
8	-	-	1	#4 Internal Tooth Lockwasher
2	2	- (*3)	28	SC-1P4-GT Lead Sockets

Notes:

(*1) - May substitute 256K RAM/Speech Board.
(*2) - For PortaBraille, omit this regulator and short the two upper pads together (O and I).
(*3) - Optional. Used only on the PocketBraille to raise the height of the Keybaord. Reference the section on constructing the microprocessor board.
(*4) - Required only on the PortaBraille.
(*5) - Firmware will be burned into your EPROM, free, by Vendor #5.
(*6) - R6 is 100K for PortaBraille; 470K for PocketBraille.

PARTS LIST FOR THE BRAILLE DISPLAY AND DRIVER BOARD

VENDOR	MFGR.	SCHEMATIC DESIGNATION	QT.	PART # AND/OR DESCRIPTION
9	14	U1,U2	2	UDN-2841B Quad Drivers
4	6	U3,U4	2	74HC374 IC
6	6	U5	1	74HC423 IC
4	6	U6	1	74HC154 IC
4	6	U7	1	74HC138 IC
4	6	U8,U9	2	74HC132 IC
3	15	U10-U29	20	MOC3010 Optical Bilateral Switch
9	-	R1,R2,R8	3	100K, 1/4 W, 5% Resistor
9	-	R3,R4	2	2.2K, 1/4 W, 5% Resistor
9	-	R5,R6	2	33K, 1/4 W, 5% Resistor
9	-	R7	1	330 ohm, 1/4 W, 5% Resistor
4	5	C1,C2,C4	3	P2054 .15 mf, 35V Tantalum Capacitor
4	5	C3	1	P2059 1mf, 35V Tantalum Capacitor
4	5	C5	1	P4104 220pf, Disc Capacitor
4	-	CR1-CR6	6	1N4148 Diodes
4	-	Q1	1	2N3904 NPN Transistor
4	-	Q2	1	TIP127PNP Transistor
9	6	VR1	1	LP2950ACZ +5V Micropower Reg.
2	2	J3	1	TSW-108-07-T-D Terminal Strip
2	2	(J3)	1	IDSD-08-D-5 Ribbon Cable Connector
2	2	J1,J2	2	SSW-108-04-T-D Socket Strip
6	13	(U10-U29)	20	C840602 6-pin, Low Profile DIP Sockets
6	13	(U6)	1	C842403 24-pin, Low Profile DIP Sockets
4	13	(U3,U4)	2	C8920 20-pin, Low Profile DIP Sockets
4	13	(U1,U2,U5,U7)	4	C8916 16-in, Low Profile DIP Sockets
4	13	(U8,U9)	2	C8914 14-pin, Low Profile DIP Sockets
16	16	-	1	PortaBraille Braille Display Driver PCBoard
9	-	-	2	#4 x 40 x 1" Hex Threaded Spacer
8	-	-	4	#4 x 40 x 3/8" Machine Screw
8	-	-	2	#4 x 40 Nuts
8	-	-	2	#4 Internal Tooth Lockwashers
11,16	11	-	1	51.820.M6 20-Cell Braille Display

PARTS LIST FOR TAPE INTERFACE BOARD

VENDOR	MFGR.	SCHEMATIC DESIGNATION	QTY.	PART # AND/OR DESCRIPTION
17	35	U1	1	MAX232 Dual RS232 Driver IC
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4	-	CR1,CR2	2	1N4148 Diodes
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10	-	XTL	1	6.5536 MHZ Crystal (HC-18 Case)
4	5	C1-C6,C11	7	P2040 22 mf, 16V Tantalum Capacitor
4	5	C7,C8	2	P4311 .1 mf Disc. Capacitor
4	5	C9,C10	2	P4004 22 pf Disc Capacitor
9	-	R1	1	1M, 1/4 W, 5% Resistor
9	-	R2,R4	2	10K, 1/4 W, 5% Resistor
6	30	R3	1	62-2-1 10K Trimpot
20	34	J1,J2	2	S-G 8026#01 3.5 mm Phone Jack
4	-	J3	1	1S25P-ND 25-Pin Male RS232 Conn.
14	31	-	1	AI-251 Audio Indicator
4	-	-	1	470C 9V Battery Snap
6	36	SW1	1	T101MH9AB SPDT R.A. PC Mount Switch
16	16	-	1	Tape Interface Printed Circuit Board
12	23	-	1	HM-9VBK Case
8	-	-	1	9V Battery
8	-	-	2	#4 x 40 x 1/4" Machine Screw
8	-	-	2	#4 x 40 Nut

VENDOR ADDRESSES AND PHONE NUMBERS

1. Sharp Electronics Corp.
   Electronics Components Group
   10 Sharp Plaza
   Paramus, N.J. 07652
   201-265-5600

2. Samtec, Inc.
   P.O. Box 1147
   New Albany, IN 47150
   812-944-6733

3. Jameco Electronics
   1355 Shoreway Road
   Belmont, CA 94002
   415-592-8097

4. Digi-Key Corporation
   701 Brooks Avenue, South
   P.O. Box 677
   Thief River Falls, MN 56701
   800-344-4539

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   427 Versailles Road
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   502-564-4754

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   502-423-0280

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9. Local Electronics Distributor

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    Bergamo
    Italy
    Tel. (0341) 642.292

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    Chicago, IL 60639
    312-384-6100

13. Local Radio Shack Store

14. Projects Unlimited, Inc.
    3680 Wyse Road
    Dayton, Ohio 45414
    513-890-1918

15. Videotape Products, Inc.
    320 N. Madison Avenue
    Los Angeles, CA 90004
    213-664-1144

16. Southland Manufacturing
    680 Bizzell Drive
    Lexington, KY 40510
    606-253-3066

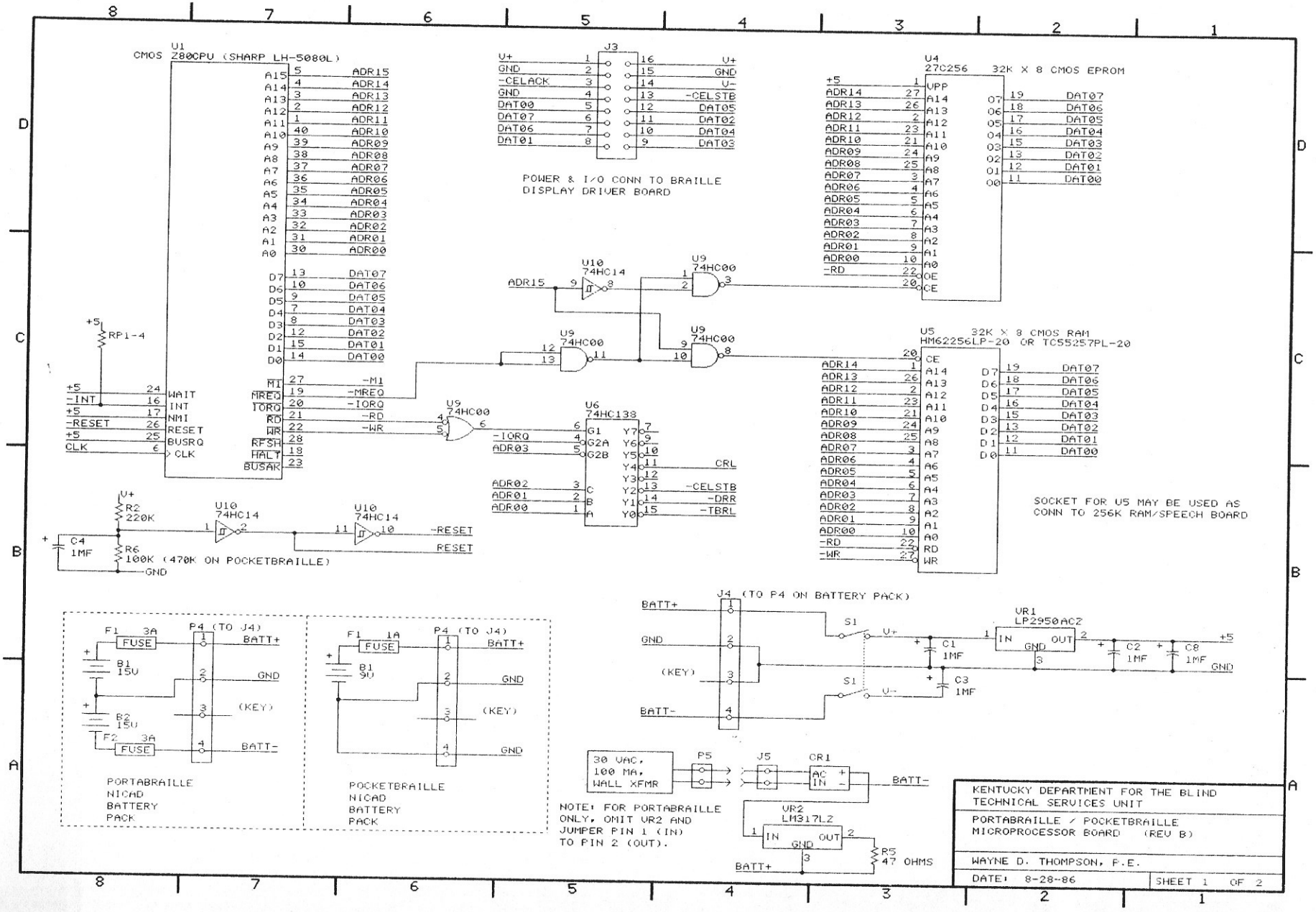
17. Hall Mark Electronics
    4275 W. 96th St.
    Indianapolis, IN 46268
    317-872-8875

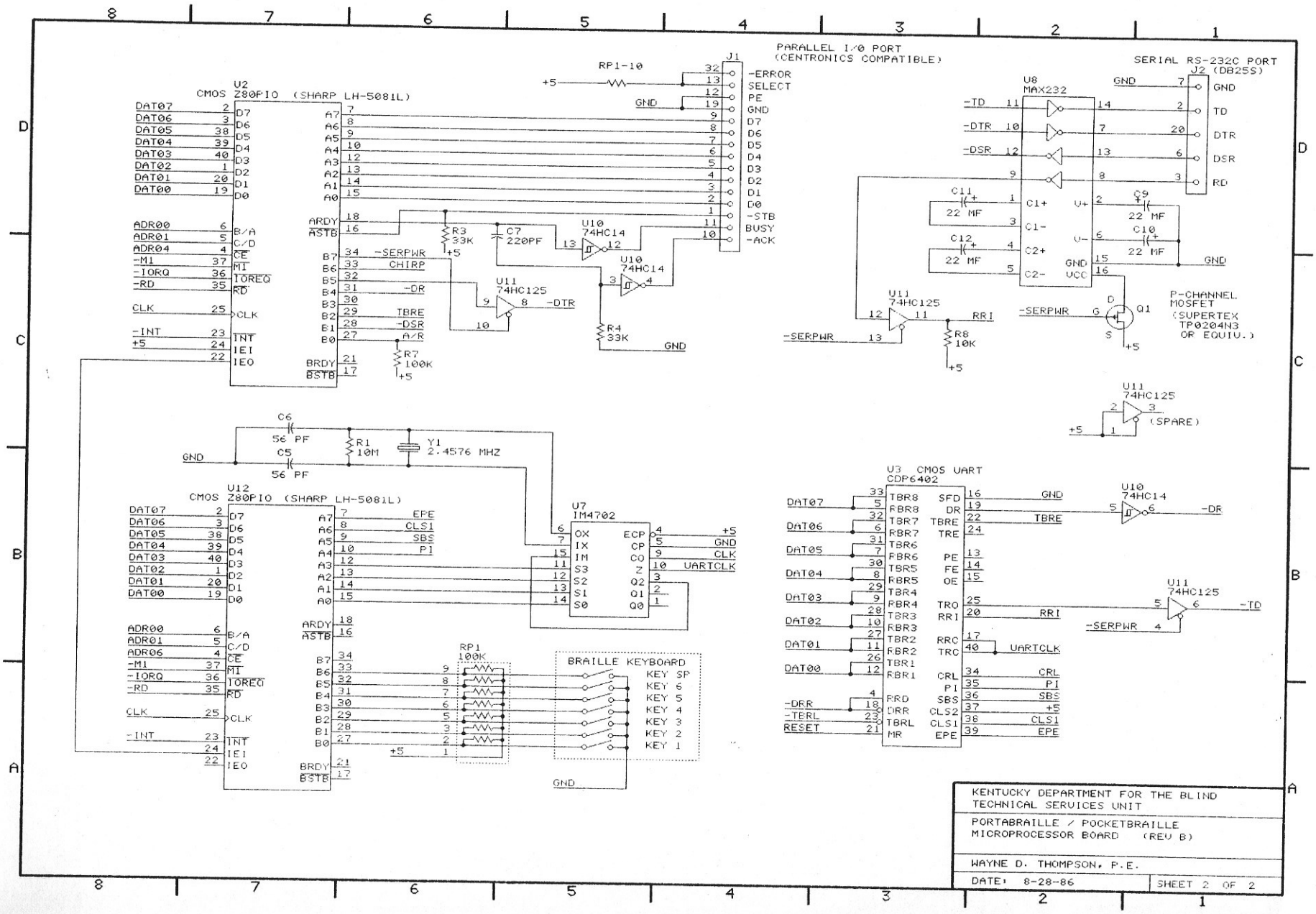
18. Diplomat Electronics

    Chicago, Illinois
    312-595-1000

19. Reptron
    404 E. Wilson Bridge Rd.
    Suite A
    Worthington, Ohio 43085
    614-436-6675

20. NEP Electronics, Inc.
    8300 W. Addison Street
    Chicago, Illinois 60634
    312-625-8400


U1
CMOS Z80CPU (SHARP LH-5080L)
J3
POWER & I/O CONN TO BRAILLE DISPLAY DRIVER BOARD
U4
27C256 32K X 8 CMOS EPROM
U5 32K X 8 CMOS RAM
HM62256LP-20 OR TC55257PL-20
SOCKET FOR U5 MAY BE USED AS CONN TO 256K RAM/SPEECH BOARD
U6
74HC138
U9
74HC00
U10
74HC14
RP1-4
R2 220K
R6 100K (470K ON POCKETBRAILLE)
C4 1MF
-RESET
RESET
-GND
J4 (TO P4 ON BATTERY PACK)
VR1
LP2950ACZ
C1 1MF
C2 1MF
C8 1MF
C3 1MF
S1
30 VAC, 100 MA, WALL XFMR
P5
J5
CR1
VR2
LM317LZ
R5 47 OHMS
NOTE: FOR PORTABRAILLE ONLY, OMIT VR2 AND JUMPER PIN 1 (IN) TO PIN 2 (OUT).
PORTABRAILLE NICAD BATTERY PACK
POCKETBRAILLE NICAD BATTERY PACK
F1 3A FUSE
F2 3A FUSE
F1 1A FUSE
B1 15V
B2 15V
B1 9V
P4 (TO J4)
BATT+
GND
(KEY)
BATT-
KENTUCKY DEPARTMENT FOR THE BLIND
TECHNICAL SERVICES UNIT
PORTABRAILLE / POCKETBRAILLE MICROPROCESSOR BOARD (REV B)
WAYNE D. THOMPSON, P.E.
DATE: 8-28-86
SHEET 1 OF 2


U2
CMOS Z80PIO (SHARP LH-5081L)
J1
PARALLEL I/O PORT
(CENTRONICS COMPATIBLE)
RP1-10
-ERROR
SELECT
PE
GND
D7
D6
D5
D4
D3
D2
D1
D0
-STB
BUSY
-ACK
U10
74HC14
U11
74HC125
R3
33K
C7
220PF
R4
33K
R7
100K
-SERPWR
CHIRP
-DR
TBRE
-DSR
A/R
-DTR
U8
MAX232
SERIAL RS-232C PORT
J2 (DB25S)
-TD
-DTR
-DSR
RD
TD
DTR
DSR
C11
C12
C9
C10
22 MF
RRI
R8
10K
Q1
P-CHANNEL
MOSFET
(SUPERTEX
TP0204N3
OR EQUIV.)
(SPARE)
C6
56 PF
C5
56 PF
R1
10M
Y1
2.4576 MHZ
U12
CMOS Z80PIO (SHARP LH-5081L)
U7
IM4702
EPE
CLS1
SBS
PI
UARTCLK
RP1
100K
BRAILLE KEYBOARD
KEY SP
KEY 6
KEY 5
KEY 4
KEY 3
KEY 2
KEY 1
U3 CMOS UART
CDP6402
TBR8
RBR8
TBR7
TBR6
RBR7
RBR6
TBR5
RBR5
TBR4
RBR4
TBR3
RBR3
TBR2
RBR2
TBR1
RBR1
RRD
DRR
TBRL
MR
SFD
DR
TBRE
TRE
PE
FE
OE
TRO
RRI
RRO
TRO
CRL
PI
SBS
CLS2
CLS1
EPE
-DRR
-TBRL
RESET
CRL
+5
CLS1
EPE
KENTUCKY DEPARTMENT FOR THE BLIND
TECHNICAL SERVICES UNIT
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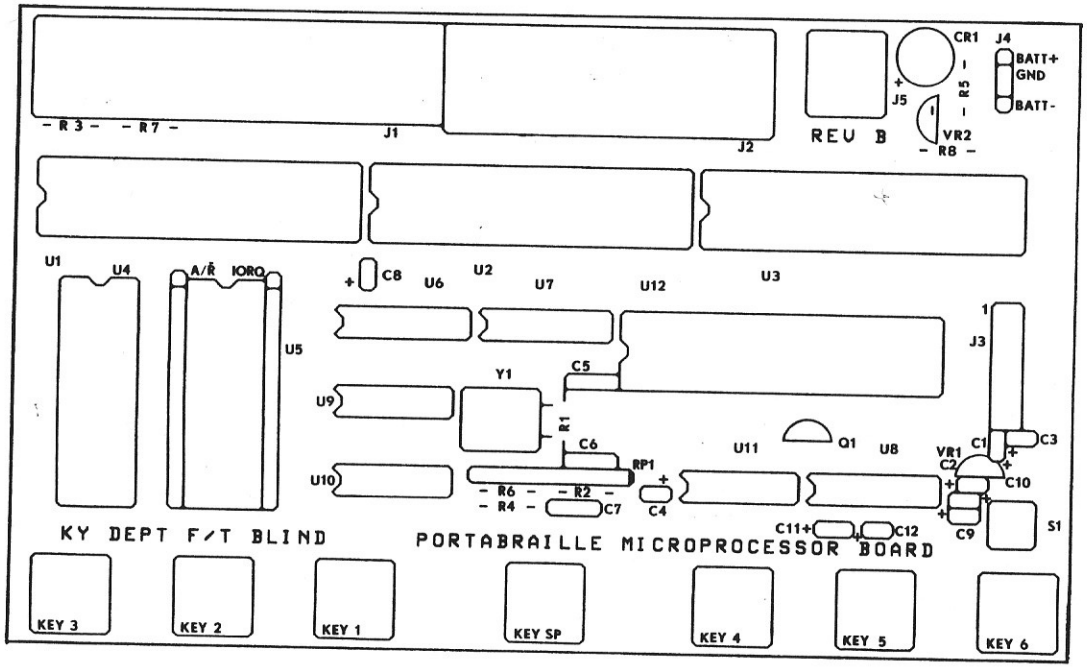
MICROPROCESSOR BOARD (REV B)
WAYNE D. THOMPSON, P.E.
DATE: 8-28-86
SHEET 2 OF 2



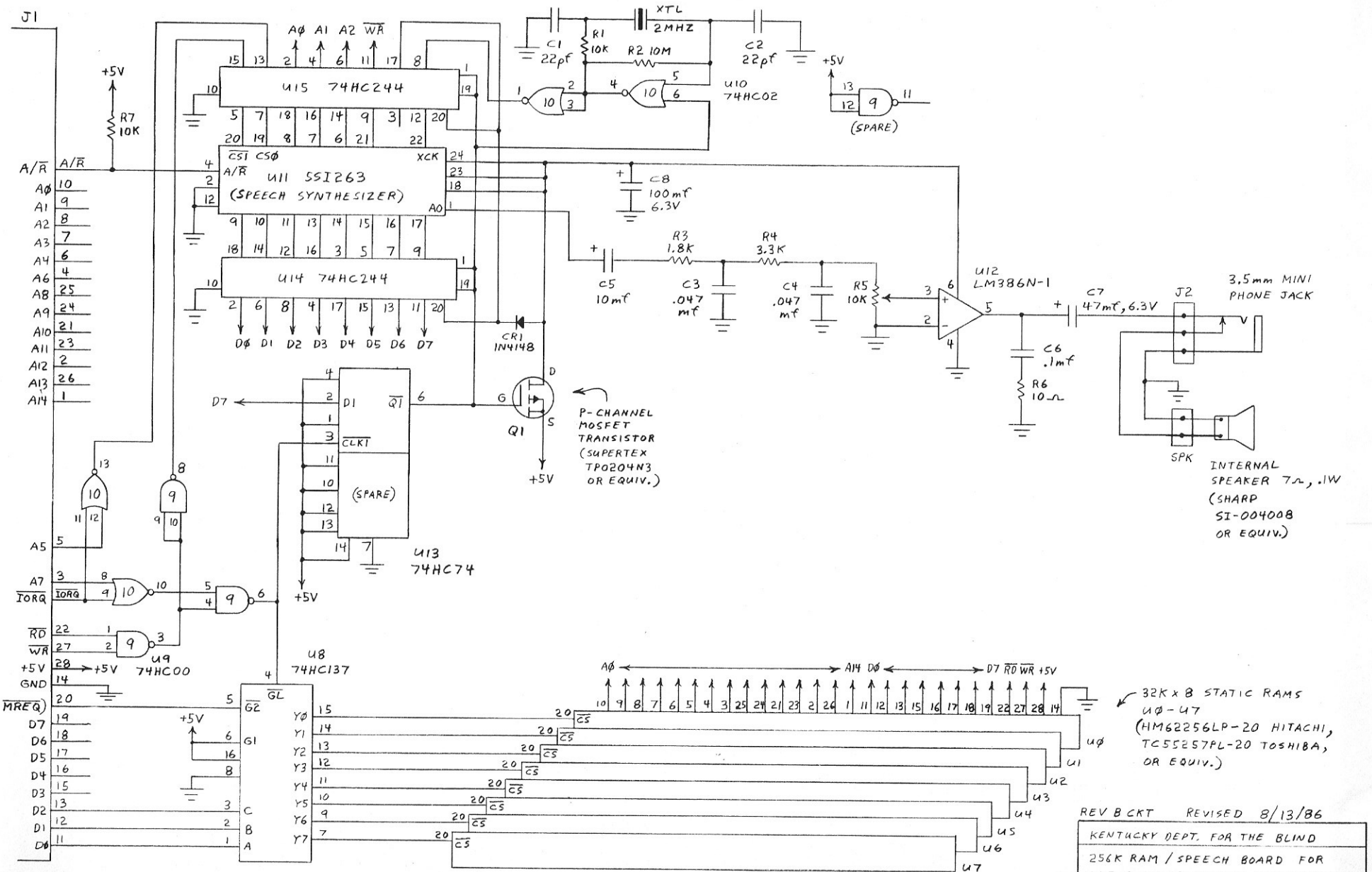
BOARD LAYOUT

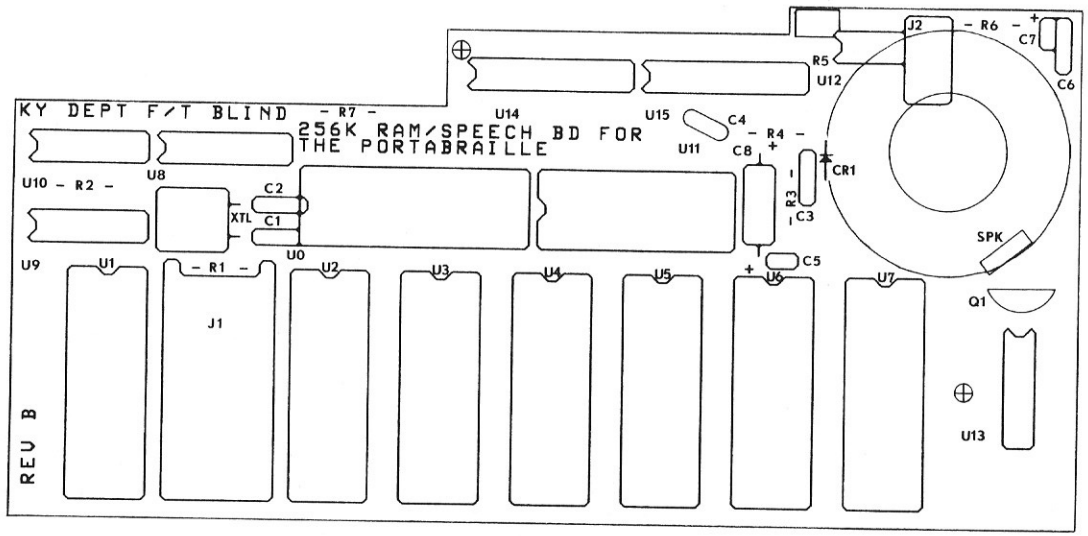
NOTES:

1) ON THE PORTABRAILLE, OMIT VR2 AND JUMPER ITS TWO UPPER PADS TOGETHER.
2) J3 IS REQUIRED ONLY ON THE PORTABRAILLE.
3) THE 256K RAM/SPEECH BOARD, IF USED, PLUGS INTO SOCKET U5.

KENTUCKY DEPT. FOR THE BLIND
PC BOARD LAYOUT FOR THE KENTUCKY PORTABRAILLE AND POCKETBRAILLE MICROPROCESSOR BOARD
WAYNE D. THOMPSON 7/85

REVISED - 8/30/86


J1
U15 74HC244
U11 SSI263
(SPEECH SYNTHESIZER)
U14 74HC244
U10 74HC02
(SPARE)
U12 LM386N-1
U13 74HC74
(SPARE)
U9 74HC00
U8 74HC137
XTL 2MHZ
C1 22pf
C2 22pf
R1 10K
R2 10M
R3 1.8K
R4 3.3K
R5 10K
R6 10Ω
R7 10K
C3 .047 mf
C4 .047 mf
C5 10mf
C6 .1mf
C7 47mf, 6.3V
C8 100mf 6.3V
CR1 IN4148
Q1
P-CHANNEL MOSFET TRANSISTOR (SUPERTEX TP0204N3 OR EQUIV.)
3.5mm MINI PHONE JACK
J2
SPK
INTERNAL SPEAKER 7Ω, .1W (SHARP SI-004008 OR EQUIV.)
32K x 8 STATIC RAMS U0-U7 (HM62256LP-20 HITACHI, TC55257PL-20 TOSHIBA, OR EQUIV.)
REV B CKT REVISED 8/13/86
KENTUCKY DEPT. FOR THE BLIND
256K RAM / SPEECH BOARD FOR THE PORTABRAILLE OR POCKETBRAILLE
WAYNE D. THOMPSON 5/86



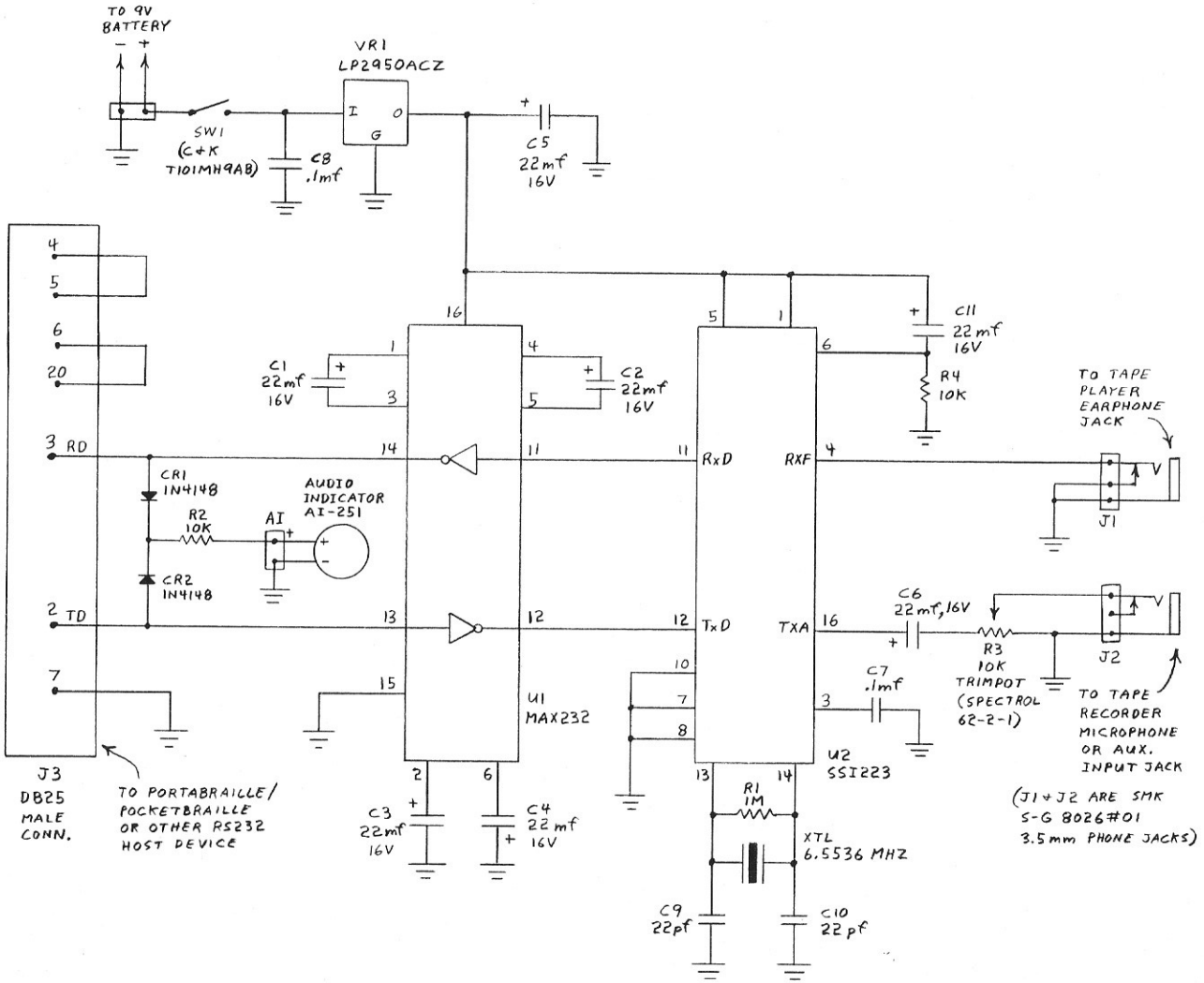
BOARD LAYOUT

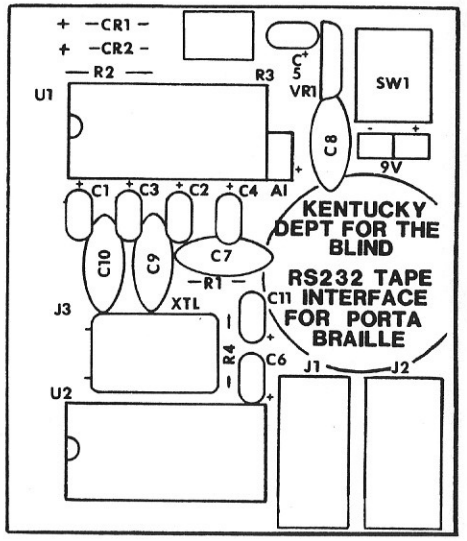
NOTES:

1) JACK J2 MUST BE MOUNTED ON THE BOTTOM SIDE OF THE BOARD.
2) PLACE A SMALL PIECE OF TAPE UNDER THE CRYSTAL AND SPEAKER BEFORE MOUNTING TO AVOID SHORTING OF PADS.
3) MOUNT SPEAKER BY COMPLETELY SEALING AROUND OUTER RIM WITH SILICONE ADHESIVE AFTER FIRST CONNECTING SPEAKER TERMINALS AND SOLDERING J2. POSITION SPEAKER TO SOLDER DIRECTLY TO BOARD PADS.
4) U0 MUST BE INSTALLED. U1 THRU U7 ARE OPTIONAL BUT MUST BE INSTALLED IN ORDER IF USED.
5) U12 MUST NOT BE SOCKETED TO ALLOW CLEARANCE FOR SPEAKER.

REVISED 8/30/86

KENTUCKY DEPT. FOR THE BLIND
256K RAM/SPEECH BOARD FOR THE KENTUCKY PORTABRAILLE / POCKETBRAILLE
WAYNE D. THOMPSON 5/86





PC Board Layout

NOTES:

1) USE PACTEC HM-9VBK CASE TO HOUSE PC BOARD.
2) J3 MUST BE MOUNTED TO OUTSIDE OF FRONT PANEL. MOUNT CASE FRONT PANEL TO J3 BEFORE SOLDERING TO BOARD. PUNCH CENTER OF PANEL.
3) MOUNT SW1 ON BOTTOM OF BOARD. LOCATE AND DRILL HOLE FOR SW1 IN SIDE WALL OF BOTTOM HALF.
4) LOCATE AND DRILL HOLES FOR R3, J1, & J2 IN SIDE WALL OF TOP HALF.
5) TRIM OFF PLASTIC MOLDED CARD GUIDES ON INSIDE SIDE WALLS OF CASE NEAR J1 + J2.

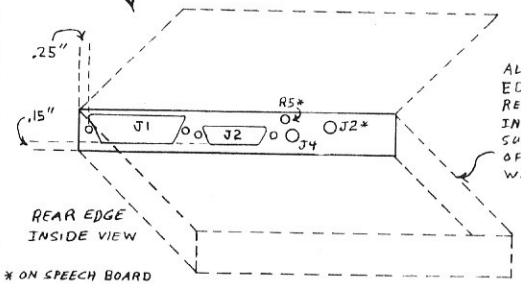
KENTUCKY DEPT. FOR THE BLIND
RS232/TAPE INTERFACE (0 TO 2400 BAUD) FOR THE PORTABRAILLE/POCKETBRAILLE
WAYNE D. THOMPSON 5/22/86

REV. 8/30/86

CASE DETAIL FOR POCKETBRAILLE ONLY

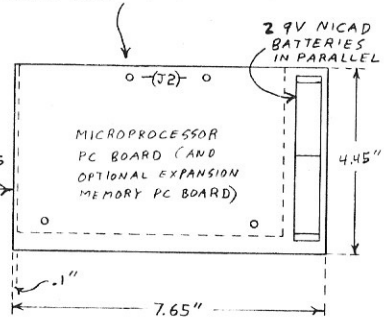
ENCLOSURE USED IS A MEMOREX VHS VIDEO CASSETTE STORAGE CASE.

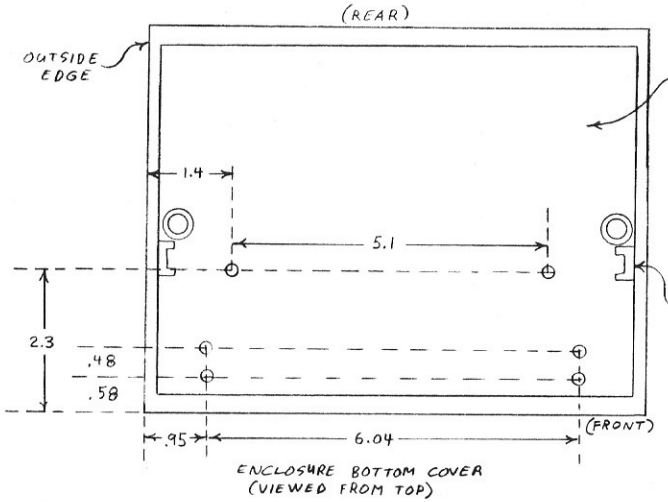
REMAINING REAR HOLE DIMENSIONS ARE SAME AS PORTABRAILLE REAR PANEL DRAWING BELOW.

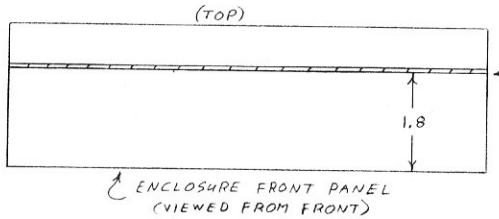


ALL DRAWING EDGES REPRESENT INSIDE SURFACE OF CASE WALLS

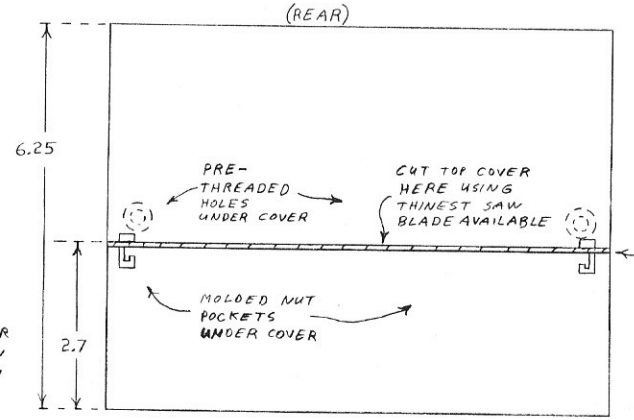
LOCATE THESE FOUR MOUNTING HOLES BY POSITIONING PC BOARD IN CASE AND USING IT AS A TEMPLATE TO MARK HOLE CENTERS. DRILL WITH #35 BIT (.110").





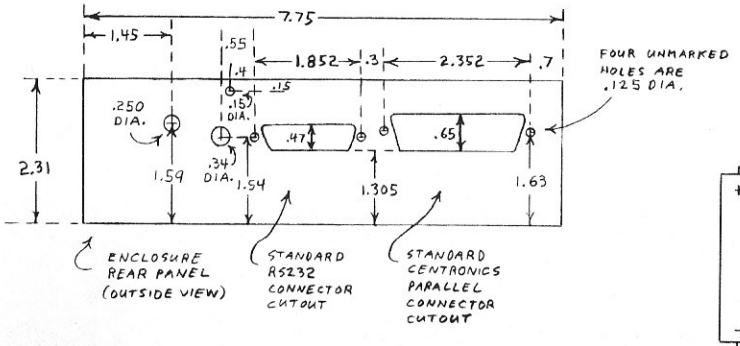


CUT FRONT PANEL HERE USING THINEST SAW BLADE AVAILABLE. THEN, GLUE TOP HALF TO TOP COVER AND BOTTOM HALF TO BOTTOM COVER. (GLUE WITH CUT EDGE AGAINST ENCLOSURE PANEL GROOVE.)

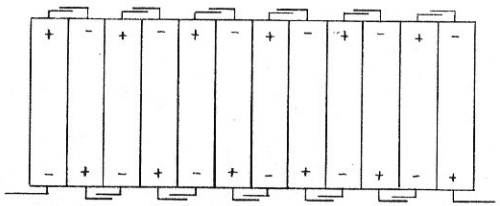


ENCLOSURE IS A PACTEC MODEL CM86-225K.

BEFORE MAKING THIS CUT, BE SURE THE TOP COVER IS ORIENTED CORRECTLY. IT IS KEYED TO THE BOTTOM COVER AND WILL ONLY FIT ONE WAY!



FOR PORTABRAILLE ONLY, TWO ASSEMBLIES OF 12 EACH SIZE AA NICAD CELLS (FAST CHARGE TYPE EVEREADY CF1ST OR EQUIV.) WITH SOLDER TABS. SEE CONSTRUCTION MANUAL FOR DETAILS ON ASSEMBLING BATTERIES.



NOTE: ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE INDICATED. NO SCALE.

KENTUCKY DEPT. FOR THE BLIND
KENTUCKY PORTABRAILLE AND POCKETBRAILLE CASE DETAILS
WAYNE D. THOMPSON 7/85

REVISED - 9/3/86

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Kentucky Department for the Blind

427 VERSAILLES ROAD, FRANKFORT, KENTUCKY 40601 (502) 564-4754

CHARLES W. McDOWELL, Executive Director

MEMORANDUM

TO: All Holders of the User's Guide for the Kentucky PortaBraille/PocketBraille

FROM: Kentucky Department for the Blind
Technical Services Unit
Fred L. Gissoni

DATE: September 11, 1986

This September 1986 revision to the User's Guide for the Kentucky PortaBraille/PocketBraille is being made to reflect various changes and additions to the operating instructions. Please discard all pages from existing manual and replace them with the attached pages.

FLG/pwg

A USER'S GUIDE
TO THE KENTUCKY
PORTABRAILLE
AND POCKETBRAILLE

By

Fred L. Gissoni

And

Wayne D. Thompson

Technical Services Unit

Kentucky Department for the Blind

REVISED September, 1986

Charles W. McDowell

Executive Director

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PARITY.....3.19
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SERIAL PORT ACTIVE.....3.21
STOP BITS.....3.22
NOTE.....3.23
INTERFACING INFORMATION.....3.24
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NOTE.....4.01
INSTRUCTIONS FOR USING TAPE INTERFACE.....4.02
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with the cleaner. Then, exercise the display back and forth between the full cell and empty cell sections; (dot 3-chord to back up and dot 6-chord to go forward (2-20, 2-21). Between each application of cleaner, lay a lint free cloth upon the display window. Use this to blot up loosened debris. In extreme cases, several repetitions of this procedure may be needed.

As mentioned at the outset, the memory expansion board contains provision for an internal speech synthesizer. If one does not wish a full set of memory chips at first, one can manage with a single memory chip. Additional memory can be increased one chip at a time. Each new chip will increase memory by 32K.

Most people who read manuals either skim through them or don't read them at all. We recommend that you read through this manual at least once in order to learn what it contains and where things are hidden. There are some points you really should know about. Failure to observe them could cause you to damage your instrument and/or loose valuable data stored in it. PLEASE BE SURE TO READ the sections dealing with batteries, output ports, the appending of line feeds in transmit mode, cursor moves, duplex, display of carriage returns and other control (CTRL) characters, speech operation and Window Options choice V. (1-07, 3-18, 3-21, 4-11, 2-18, 2-19, 2-20, 2-21, 2-22, 3-15, 2-06, 2-09, 3-01, 3-03, 3-08)

If you experience problems with your instrument, we would like to know about them. Try to be as specific and detailed in reporting problems as you can and we will make every effort to correct such unfortunate conditions. Communicate such information either to the manufacturer of your PortaBraille or to the Technical Services Unit, Kentucky Department for the Blind, 427 Versailles Road, Frankfort, Kentucky 40601; (502) 564-4754.

1.02 DESCRIPTION OF PORTABRAILLE

The PortaBraille measures about eight inches wide, six inches deep and two-and-a-half inches thick. Place the instrument on a table with its four rubber "feet" down. The back panel, the one with the projections, should face away from you.

If you lift upward on the front portion of the cover, it will swing up and away from you. This will reveal the PortaBraille keyboard. It is a seven key board much like that of a braillewriter. The larger key in the center is the space bar. Keys for dots 1, 2 and 3 are to the left and for dots 4, 5 and 6 are to the right of the space bar.

The PortaBraille has a 20-cell braille display. This display is between the keyboard and the front of the instrument. When the display is active, a short voltage pulse energizes the pins which form braille dots, causing them to pop up and latch in place. There they will remain until another voltage pulse releases them. If you turn the power off with pins raised, they will stay raised.

Your first step in operating the PortaBraille is to turn on the power. To locate the power on/off switch, place a finger on the key for dot 6, the right most key on the keyboard. The key will feel as if it has a round top resting on a square platform. Just

The major difference between the PocketBraille and the PortaBraille is that the PocketBraille has no braille display. Data in its text memory can be transferred to an external computer for editing and storage, or, if your PocketBraille is equipped with speech, you may use its speech display for reading and editing.

1.05 REAR PANEL FEATURES

As you know, the PocketBraille is smaller than the PortaBraille. Otherwise, rear panel features of the PocketBraille are the same as those found on the PortaBraille.

Now we need to get down to the business of actually learning to use these two instruments.

1.06 WRITING AND ISSUING COMMANDS

When you turn the PortaBraille on by sliding the on/off switch to the left, you will hear something which sounds like a row of dominos falling. This is the system clearing the braille display window and preparing to receive your commands. If your unit is equipped with speech it also will say "ready". All this lets you know that it has accepted power. If you do not hear this sound when the power is switched on, something is wrong.

When you turn on the PocketBraille, if it is equipped with speech, you will hear the word "READY". This means that the unit has taken power and is ready for action. Later, you will learn how to set speech parameters so you can set rate, volume and pitch of speech and control the amount of text read at a given command. (3-03)

Having turned our instrument on, we are ready to issue commands. When we write with either instrument we are able to use any kind of braille we like: grades 1, 2 or 3, music, foreign languages, mathematics notation, etc. If we print out our braille keyboard entries in braille, what we put in is what we will get out. If we want our data to be printed out in ink, we need to write in "COMPUTER BRAILLE". In computer braille, the letters of the alphabet are as you already know them. Numbers 1 through 0 are written in the four lower dots of the braille cell. The number sign is not used. Punctuation marks differ from those used in literary braille but they are easy to learn. A complete listing of the computer braille character set is the last section of this manual.

When you issue commands, you must issue them in computer braille. This should cause you no problem, but where the comma and numbers are required take special care until you become familiar with the computer braille system.

This manual contains a list of the commands which the PortaBraille and PocketBraille will recognize. The list occurs twice. In the first listing, when it seems appropriate to do so, we have followed each command or set of related commands with discussion. This first listing is divided into three categories. First, we treat READING/WRITING commands (2-01). These are the ones you will need to use in writing with either instrument and in reading back what

20-cell braille display between the keyboard and the front of the machine.

After you have written 20 characters the clicking will stop. No, the PortaBraille is not broken. Instead, the display window is full and the characters you continue to write are going into the memory of the device without being displayed.

If you like, you can set the display window so that it will follow along as you write. This will allow you to look at the last character you have written (3-08). Doing this consumes considerably more battery power than simply writing without "scrolling" the display window.

If you write in memory without having the display window follow along, when you have finished, you may read what you have written by advancing the "window" one display at a time. You may scan by checking the start of each new line or move the window forward one paragraph at a time (2-20, 2-21). (A line is defined as any block of text bounded by a single carriage return or carriage return line feed combination. A paragraph is defined as having boundaries of two consecutive carriage returns or carriage return line feed combinations.) You even can leap forward by a number of lines. You can leap to the very end of your text, the "electronic page" on which you are writing. What you can do in a forward direction, you also can do in reverse. This manual is written in order to tell you just how to do all these things and more. Before you do much with your instrument, you need to know about the care and feeding of its battery power supply.

1.07 THE BATTERY POWER SUPPLY

The PortaBraille's battery pack consists of 24 size AA nickel cadmium (NICAD) cells. The way you use and care for this power supply can affect both the length of its life and its ability to hold a charge. For best performance, do your best to stay with the guidelines presented here.

The hours of use you can get from a PortaBraille with a fully charged battery pack depend almost entirely on how much you use the braille display window or internal speech. The "SELF TEST" displays a new line of braille every four seconds (4-18). Placing the PortaBraille in this mode with a fully charged battery pack would give you about ten hours of service. In normal use you would not be exercising the display window that much. Therefore, you probably can count on many more hours of normal operation. If very little use were made of the display window, you could leave the PortaBraille turned on for several weeks and still have its text memory in tact. After this length of time, the PortaBraille might be operable even though the batteries might be too weak to drive the braille display.

Whenever the PortaBraille is not actively processing data, it automatically enters a "power down stand by" mode and consumes very little power while awaiting your next command or more incoming data. When not in use, NICAD batteries still lose about 1 percent of their charge per day at room temperature. This is due to self discharge.

The PocketBraille is charged with the same 30-volt A. C. wall transformer used for the PortaBraille. Each instrument has its own current requirements and these needs are met internally by each instrument. The charging transformer is terminated with a coaxial plug which plugs into the power jack on the back of the PocketBraille as described in "REAR PANEL FEATURES".

With heavy keyboard and/or input/output usage, a full charge will last about ten hours. With light keyboard or input/output usage, the PocketBraille will remain "powered up" for several days.

1.09 NOTE: We advise PocketBraille users to turn speech off, (3-01), when they expect not to be using the PocketBraille for periods of a few minutes. When it is on, the speech system consumes power rather quickly and the practice of turning speech off will go a long way in helping to conserve power.

2.00 COMMANDS AND HOW TO USE THEM

In the text which follows, the letters "ctrl" stand for the "control character". [Y, N] means "yes, no". When "Y" or "N" is part of a command it is entered and not the word "YES" or "NO".

2.01 READING/WRITING COMMANDS

2.02 APPEND: always active appends data to end of text unless in insert mode

Unless you are in the INSERT mode, (2-16), as you write on the PortaBraille or PocketBraille, that which you write always is written at the end of current text in memory. In other words, if you had a letter from a friend stored in the PortaBraille and were reading it, you could answer it at the same time without destroying the stored letter. Your reply simply would begin right after the end of your friend's letter.

2.03 BACK SPACE dot 2-chord

As you write, if you know you have just made an error, use the back space to remove the incorrect character and enter the correct one. Those characters over which you may have had to back space will be gone. Like the APPEND feature, the back space works from the end of your text. If you are reading somewhere in mid text and find an error, you will need to use the DELETE and/or INSERT function to correct it (2-10, 2-16).

2.04 BRAILLE DISPLAY ON: dots 1246-chord [Y, N]

When the PortaBraille is turned on, the braille display is turned on. You may wish to turn it off either to conserve battery power or to reduce noise in special situations. Use choice "N" to do this. PocketBraille users would do well to do this in order to cut command response time.

2.05 CARRIAGE RETURN/LINE FEED PAIR: dots 46-chord

Using this command is like pressing the carriage return key on

intend the deleting to begin.

2.11 CAUTION: Normally, CTRL characters other than carriage returns are displayed as spaces. However, it is possible to turn this option off. If it is off and you want to count characters for purposes of deleting them, even though you are not displaying the presence of these CTRL characters, the PortaBraille systems will count them as characters. Thus, it may appear to you that you have deleted fewer characters than you intended. Further, if you want to delete an entire line, remember that your display cursor must be at the very beginning of the line. Otherwise only that portion of the line from the point of the cursor onward will be deleted.

The system interprets spaces, tabs, carriage returns, line feeds and form feeds as word limiters (boundaries). Any punctuation marks contained between a word and the boundary which follows it will be considered a part of the word and deleted along with it. If a word is connected to text which follows it by means of a slash or dash (/-), deleting the word will also cause the connecting mark and the first word in the following text to be deleted along with it. If you want to delete a word, be sure that the display cursor is on the first character of the word AND NOT on the space to its left. Since the space is a word limiter, placing the cursor on a space and then deleting a single word will only delete that single space.

The system defines a line as a block of text bounded by single carriage returns, or single carriage return/line feed pairs. Paragraphs are bounded by double carriage returns or double carriage return/line feed pairs. If no number is used in connection with the command, the system assigns a value of 1. Thus, D-chord C E-chord would result in the deletion of one character.

2.12 FIND: F-chord string (up to a maximum of 255 characters) E-chord

The FIND command is the one you will use to take you quickly FORWARD or BACKWARD to any portion of your text memory. The actual search begins with the first character beyond the current location of the display cursor. Depending upon how you terminate the command, you can search in either a forward or backward direction (2-14). To search forward, enter the F-chord. The text window will clear. Write in the string of characters for which you are searching and finish the operation with an E-chord. If the search is successful, the window will show at least the first 20 characters of the set of characters sought by you. The display cursor will be UPON the first character of the set. You must write the set of characters for which you are searching EXACTLY AS THEY APPEARED in the text except for upper and lower case (2-15). If the character string for which you are searching is not found, the message "not found" appears in the text window. Tap any key to remove the message and return the display window to normal. When you are using the FIND or INSERT option, (2-16) the text window "scrolls"; it follows you as you write. This allows you to see what you are writing so you can tell if you have made an error in entering your find or insert character string. If you are using the FIND command in preparation for inserting or deleting text,

external source. If you do, the incoming data will become a part of the INSERT or FIND character strings and create chaos.

2.18 MOVE WINDOW CURSOR TO RIGHT ONE CHARACTER: dot 5-chord

2.19 MOVE WINDOW CURSOR TO LEFT ONE CHARACTER: dots 45-chord

These first two MOVE commands move the display cursor WITHIN THE 20-cell WINDOW, but not the window itself. Normally, the display cursor is UPON THE CHARACTER IN CELL 1 of the window but invisible "untouchable" if you like. Entering a dot 5-chord does two things. First, it moves the cursor to the right one character position (cell). Second, it makes it touchable in the form of a full six-dot cell. Using the MOVE WINDOW CURSOR LEFT (dots 4-5), you can return it to cell one of the window. The cursor is free to move wherever you like using these commands but only within the confines of the 20-cell window. Having moved the display cursor to the right to cell 20, or left to cell 1, continuing to press the appropriate display cursor move chord will do nothing. To get the display cursor "out of the box" you will need to use one of the MOVE WINDOW commands. Whichever way you move the window, the display cursor location will reset to cell 1 of the new text window and become invisible again. Think of such an operation as a DISPLAY CURSOR RESET.

2.20 MOVE WINDOW TO NEXT DISPLAY: dot 6-chord
TO NEXT LINE: dots 56-chord
TO NEXT PARAGRAPH: dots 456-chord
TO END OF TEXT: Z-chord

2.21 MOVE WINDOW TO PREVIOUS DISPLAY: dot 3-chord
TO PREVIOUS LINE: dots 23-chord
TO PREVIOUS PARAGRAPH: dots 123-chord
TO BEGINNING OF TEXT: A-chord

In case it has escaped your notice, all of the MOVE WINDOW commands just given follow a certain logic. It is intended to make learning and remembering the commands easy. As the forward moves increase in length, one more dot is added to the move-chord and it is on the right half of the keyboard. Backward moves, at the left of the keyboard, operate in a similar way. The expression "from A to Z" usually means from start to finish. In this case, it means from beginning to end of text.

These move capabilities make reading and skimming through text easier. If all notes on a given topic are separated by single carriage returns, one can move from one note to the next within the topic with a MOVE WINDOW TO NEXT LINE command. If a double carriage return is used to mark a change of topic, moving by paragraphs can move the window from one topic to the next quickly.

2.22 MOVE WINDOW FORWARD OR BACK n LINES: #-chord + or - n E-chord
n = number of lines, up to 255; - before the number moves back, no indicator or a plus sign moves forward

This command allows you to move the window forward or backward a number of lines which you specify. This command can be useful in

characters when shifted into the CTRL register, become CTRL (control) characters. The carriage return character is a CTRL M. If you use the command under discussion, the window rearranges itself. All non-CTRL characters are replaced with dashes and the alphabetic representation of the CTRL character is shown in its appropriate place. Thus a carriage return (CTRL M) appears as an M. A line feed character (CTRL J) is shown as a J. A carriage return/line feed pair would appear as "MJ". Tap any key to return the window to normal.

In communication with computer networks, there are times when the network sends a CTRL-G to ring the bell of a terminal. Usually, this is done to indicate the presence of a special message. Since the PortaBraille systems have no bell, using the FIND command and looking for a CTRL-G would reveal the presence of such a character. If CTRL characters are being displayed as spaces, (2-09) the result of the search for a CTRL-G would be to place the display cursor on a blank space. Invoking the R-chord C command would cause the letter G to appear in the space. Immediately to its right would be the start of the special message. To "FIND" a CTRL-G, you would enter F-chord dot 4-chord G E-chord.

2.25 SHOW WINDOW CURSOR ROW AND COLUMN: C-chord (when in video mode, 3-08)

When used, this option displays the row and column number of the cursor on the selected screen. In reading a selected screen, if an error is found, move the PortaBraille display cursor to the point of the error. Issue this command and the screen line and column number on which the character exists will be displayed. Tap any key to return to original display.

2.26 SHOW WINDOW WITH FIRMWARE VERSION NUMBER: V-chord

Firmware is the set of instructions which tells your PortaBraille or PocketBraille which commands to recognize and how to obey them. "Firmware" differs from "software" in that software is a program or set of programs loaded into a system from an external medium such as disk or tape. Firmware is an integral part of the system and is written into "read only memory" (ROM) one of the "chips" contained in the device for which it is written.

As changes are made in these instructions because of discovered bugs, new features, etc., firmware is changed. Therefore, in reporting a problem or discussing the behavior of your system, it is important to be able to know which version of the firmware you have. To see this number (it is like a model number or an edition number), simply issue the above command. The display will show "version #" and a number such as "version #1.29". Tap any key to return the window to normal.

2.27 SHOW WINDOW WITH FREE MEMORY: dots 156-chord

When you invoke this option, two numbers appear in the window. The first is the location of the display cursor. The second tells how many character spaces are left in your text memory; the amount of room you have left for writing. A comma separates these items. Tap any key to return the window to text display.

within the display "window" to be heard (2-18, 2-19).

In order to have the speech system speak out the entire text, you must enter the "SPEAK TEXT" command. This is dots 12456-chord (3-00).

Note that the speech parameter commands are single key strokes and not chords. Note also that when you have set all speech parameters to your liking, you must leave the SPEECH PARAMETER SET mode with an E-chord before you can do anything else.

If you are using the PocketBraille and wish to have speech feedback for every key stroke, as when writing in grade 2, you should lock upper case on (U-chord U-chord). In addition, you should send the following command to the PocketBraille: CTRL-A2B. These three characters are written together with no separating spaces. Follow this command with a carriage return. Then, issue the "SPEAK TEXT" command (dots 12456-chord). Finally, to be sure the command is being obeyed, press dot 4, 5 or 6. You should hear "at", "quote", or "comma". Once this has been confirmed, you can use the back space (dot 2-chord) to delete the command and test characters from your text. CTRL-A2B tells the speech system to pronounce punctuation marks and to express numbers as digits rather than ranking them in numeric order.

3.04 NOTE TO APPLE SUPER SERIAL CARD USERS: If you are transferring files between the PortaBraille or PocketBraille and an Apple IIe WITH SUPER SERIAL CARD you will have difficulty because the CTRL-A is a signal which is used in defining certain parameters to the Super Serial Card. You should assign another control signal to the Super Serial Card before beginning the process. For detailed information see the manual for your Super Serial Card.

3.05 UPPER CASE--LOCK ON: U-chord U-chord

In the default (power on) condition, the PortaBraille and PocketBraille write in lower case. This command is used to lock writing into upper case. Having issued the command, all characters which follow are in upper case until the system is returned to lower case with a Q-chord or until the power is turned off.

3.06 UPPER CASE--UNLOCK: Q-chord

3.07 UPPER CASE--NEXT CHARACTER ONLY: U-chord

This command functions as the shift key on a typewriter. The first character following the command is written in upper case and the system immediately returns to the lower case writing mode.

3.08 WINDOW OPTIONS: W-chord [C, Q, S, V, W]
C = cell, S = scroll, V = the screen which is selected, W = word, Q = column mode
to read columnar text, enter W-chord Q followed by a 1, 2 or 3 digit number, followed by a comma and another 1, 2 or 3 digit number (255 max). The command is terminated with an E-chord.

This command arranges the text window so that text can be read in five different ways.

computer with PRINT-IT! card (80 column mode) with the dots "16-chord 8" command, you must call upon "window option V" to invoke your selection. Since video screens often contain many blank lines or portions of lines, there are times when you may find it convenient to use the "window--skip blank" command (3-10). You should do this only after you are acquainted with the make-up of the video screen and applications program with which you may be working.

3.09 CAUTION: When you invoke W-chord choice V, REMEMBER that carriage returns and all other control (CTRL) characters are not displayed. This is done to give as true a representation of screen spacing as possible within the PortaBraille display window. If you like, you may display such characters by turning on the appropriate G-chord option and selecting M-chord Y (2-06, 2-09). REMEMBER! When you enter this option, the entire PortaBraille or PocketBraille buffer is emptied. Any text you have in memory is gone forever. This also happens each time you up-date your "screen display".

3.10 WINDOW--SKIP BLANK: dots 12346-chord [Y, N]

As you advance the text window from one display to the next, there are times when you might have to pass through several sets of empty braille cells before encountering new text. This command skips through all 20-cell sets of blank spaces. This is true whether you are moving the window forward or back through your text. The default is for this option to be active. When it is, control (CTRL) characters, including carriage returns, are not displayed as spaces. It automatically ignores them if they are surrounded by blank spaces. If you want to examine your text "microscopically", set this option to "no". (3-08).

3.11 COMMUNICATIONS COMMANDS

3.12 NOTE: These commands are used to maintain serial communication between the PortaBraille and external devices. Assuming that the communications parameters here match those of the external device, The only command you will need to issue in order to receive incoming data is the one which turns on the serial port, (dots 25-chord Y).

You may wish to use your PortaBraille or PocketBraille to communicate with a computer network. In such a case, you will need to learn the requirements of the network for "logging on" (signing into the system). When you are receiving incoming text, there may be times when the network will send enough information to fill the buffer (text memory) of your braille device. When this happens, the text window of the PortaBraille will show "BUFFER FULL". This same message will be spoken. However, the "BUFFER FULL" message does not come to you automatically the instant the text memory is full. The condition called "handshake" prevents additional data from entering the PortaBraille or PocketBraille (3-17). When you read through to the end of your text and try to go beyond the end with one additional advance of the display window, the message comes to you. What you must do in such a case is remove some text from your PortaBraille's memory. Having read your text you may be willing to delete it (2-10). If you wish to save it, you may do so

input port. Thus, data can be sent to it from any external device which has parallel output capability. There may be times when you want to use your PortaBraille to send data to another device which has parallel input. Most likely, this will be an ink printer. In order to do this, your PortaBraille's parallel port will need to be switched so that it is an output port. This is the command by which you do this switching. If you do use parallel output, you will need a simple cable adapter for the cable which connects your PortaBraille to the parallel printer or other device.

3.19 PARITY: P-chord [N, E, O]
N = none, E = even, O = odd

See section 3-23.n

3.20 REJECT ORNAMENTATION CHARACTERS: dots 1256-chord [Y, N]

When data are being transferred from some external sources such as computer networks, often characters are used to decorate the video screen or to enable data to be printed out in attractive columnar form. Though ornamental or useful when presented to the eye, they do nothing for the reader using braille or speech. Invoking this command allows you to trap out such characters. When this command is operative, the system looks at all incoming characters. If a stream of data contains three or more consecutive occurrences of the same punctuation or control character, the first two are allowed to enter the PortaBraille's memory. All the rest are rejected. Thus, if an external system sends a string of 30 stars, the PortaBraille would retain the first two and reject the remaining 28. This command also rejects strings of spaces but it does not apply to letters or numbers.

3.21 SERIAL PORT ACTIVE: Dots 25-chord [N, Y]
N = inactive, Y = active

The PARALLEL port operates only in one direction at a time. Either it is being used as an input port to receive data or as an output port to send data out of the PortaBraille. Unlike this port, the RS232 SERIAL port is bi-directional. It is both an output and an input port at the same time. In order to conserve power, especially in the case of the PocketBraille, the serial port normally is turned off. Before you will be able to communicate with any external device through this port, you will need to turn it on first. Dots 25-chord Y is the way that you do it.

3.22 STOP BITS: Y-chord [1, 2]

3.23 NOTE: All of the commands listed in this section are concerned with communication between the PortaBraille and some sort of external device. Where serial communication is employed, all of the parameters listed here must match those of the other device. They deal with such things as the speed of transmission, length of each character, recognition of end of one character and start of the next, and the control of transmission between devices which may, due to their nature, operate at different speeds.

3.24 INTERFACING INFORMATION

4.00 USING THE TAPE INTERFACE DEVICE

You can save PortaBraille data by storing it on audio cassette. When you do, the signals on tape are not voice signals. Instead, they are tones which can be sent back to the PortaBraille (or PocketBraille) and decoded as text and displayed as braille or speech. This is done by means of the tape interface device. This device is a little plastic box which is about two inches wide, one inch thick and three inches long. One end of the box contains a connecter which fits the RS232 port on the back of the PortaBraille (1-03) and PocketBraille (1-05). When the tape interface device is plugged into the PortaBraille, it appears to be an extension of the PortaBraille itself.

In the correct operating position, ready for connection to the PortaBraille, the switch on the side of the tape interface device will be at the left side of the box. This is the on/off switch. When it is flipped toward the PortaBraille connection point, the interface is turned on. When it is flipped away from the PortaBraille end, it is turned off.

4.01 NOTE: When you turn the interface on you will hear a high pitched "beep". Sometimes this beep will be a tone which stays on. If it does stay on, turn the interface device off and back on until the steady tone is simply a short beep.

On the right side of the box there are two jacks. The one nearest the PortaBraille end of the box is the INPUT jack. Signals entering the PortaBraille from the tape recorder use this input jack as their entry point. The jack farther from the PortaBraille end is the OUTPUT jack. Signals traveling from PortaBraille to tape use the output jack as their point of departure from the PortaBraille. On the side of the interface box which contains the on/off switch, there is a small hole. It is between the switch and the PortaBraille end of the box. If necessary, you can insert a small screwdriver into this hole in order to set the volume of the interface device. Chances are this will not be necessary. We have set these devices at about mid range and this setting seems to work well on a variety of recorders.

On the under side of the box toward the far end of the box from the PortaBraille connection point you will feel a rough area. This is a grip and indicator pointer for the battery compartment. Press on this rough grip with your thumb and push away from the PortaBraille connection point. This causes the battery cover to slide away. Inside the interface box is a nine volt transistor radio type battery with two snap terminals on one end. This battery powers the interface unit. This is not a rechargeable battery. It will have to be replaced when it no longer is able to power the unit.

4.02 INSTRUCTIONS FOR USING TAPE INTERFACE

4.03 SAVING DATA ON TAPE

To transfer data from the PortaBraille memory to an audio cassette, do this: Using the tape recorder's microphone, make a voice label describing the file to be transferred. Connect one end of a

use of "Certified Cassette Tape". These are certified to be free of "drop-out". They come in 20 and 10 minute track lengths. The Radio Shack catalog number for a C20 (20 minutes per track) cassette is 26-301.

4.06 VOICE LABELS

The making of voice labels is a matter of personal preference. However, you might find it helpful to begin each label with a set of three numbers such as 1-2-7. The first number would refer to the number of the specific cassette in a set of data storage cassettes. The second number indicates the track on which the file in question is being recorded. Finally, the third number is the number of the file on that track. You might follow this information with a word description of the file. The numbering system serves as an "address" for locating a given set of information. One might make a set of index cards or even a special index cassette containing descriptions and addresses of stored files.

4.07 OTHER COMMANDS

4.08 ABORT: dots 36-chord

This command aborts "INSERT, FIND", and terminates "SERIAL/PARALLEL CONVERSION" (2-16, 2-12, 4-15). If you issue the insert command and change your mind, this prevents accidental insertion of an "insert or find string" into text. In addition, this command aborts the transmission of data and releases the handshake line in the event of a "handshake hang-up" (4-19).

4.09 JUMP TO USER PROGRAM: dots 12356-chord [Y]. We have added "hooks" which enable programs to be loaded into the PortaBraille or PocketBraille. If you have a program which is to be loaded from an external source, this command is the one you must use in order to access it after it has been loaded (4-13). The reason for the Y in this command is to cause you to be certain you have thought about what you are about to do. If you use this command and there is no user program to which to jump, the system is guaranteed to "crash". The only thing to do then is shut it down and restart.

4.10 KEYBOARD ACTIVE: K-chord [Y, N]

When you turn on your PortaBraille, it is ready to write immediately. The keyboard is active. There are times when you may want to make the keyboard inactive so that accidental key strokes are not made a part of your text. This is the command with which you do it. Setting the keyboard to "inactive" also powers down the speech and serial port circuits automatically (3-01, 3-21). Resetting the keyboard to "active" restores power to these circuits.

4.11 LINE FEED APPEND IN TRANSMIT: J-chord [N, Y]

As you write text there will be times when you need to enter carriage return characters. If this text is transmitted to an external device such as a printer and if that printer is not set to append a line feed when it receives a carriage return, all your

L = line, P = paragraph, Z = all from current window cursor location to end of text.

This is the command to use in sending data from your system to an ink or braille printer, a modem or an external computer. Transmission takes place through the output port (s) which you have selected (3-18, 3-21). When text is being transmitted the message "SENDING TEXT" appears in the braille window until the transmission is complete.

JUMP TO USER PROGRAM: dots 12356-chord Y (4-09)

KEYBOARD ACTIVE: K-chord [Y, N] (4-10)

LINEFEED APPEND IN TRANSMIT: J-chord [N, Y] (4-11)

LOAD USER PROGRAM: 146-chord [N, Y] (4-13)

MOVE WINDOW CURSOR TO LEFT ONE CHARACTER: dots 45-chord (2-19)

MOVE WINDOW CURSOR TO RIGHT ONE CHARACTER: dot 5-chord (2-18)

MOVE WINDOW FORWARD OR BACKWARD n LINES: #-chord + or - n E-chord
n = number of lines, up to 255; - before the number moves back, no indicator or a plus sign moves forward (2-22)

MOVE WINDOW TO BEGINNING OF TEXT: A-chord (2-21)

MOVE WINDOW TO END OF TEXT: Z-chord (2-20

MOVE WINDOW TO NEXT DISPLAY: dot 6-chord (2-20)

MOVE WINDOW TO NEXT LINE: dots 56-chord (2-20

MOVE WINDOW TO NEXT PARAGRAPH: dots 456-chord (2-20

MOVE WINDOW TO PREVIOUS DISPLAY: dot 3-chord (2-21)

MOVE WINDOW TO PREVIOUS LINE: dots 23-chord (2-21)

MOVE WINDOW TO PREVIOUS PARAGRAPH: dots 123-chord (2-21)

OUTPUT LINE LENGTH: S-chord N E-chord
n = 1, 2 or 3 digit number (255 max) (4-14)

PARALLEL PORT DIRECTION: dots 35-chord [I, O]
I = input, O = output (3-18)

PARALLEL/SERIAL CONVERSION: dots 23456-chord [P, S]
P = parallel to serial, S = serial to parallel. (Terminate with dots 36-chord.) (4-15)

PARITY: P-chord [N, E, O]
N = none, E = even, O = odd (3-19)

REJECT ORNAMENTATION CHARACTERS: dots 1256-chord [Y, N] (3-20)

RESET--WARM: dots 123456-chord dots 123456-chord (4-16)

SCREEN SELECT: dots 16-chord [I, R, 8, 4]
I = IBM PC, R = Radio Shack Model 100, 8 = Apple computer with PRINT-IT! card (80 column mode), 4 = Apple computer with PRINT-IT! card, (40 column left justified mode) (2-23)

SELF TEST: hold down dot 2 as power is turned on. Turn unit off to end. (4-18)

SERIAL PORT ACTIVE: dots 25-chord [N, Y] (3-21)

5.01 ESCAPE SEQUENCES

In the following listing, the abbreviation "ESC" means "escape".

ABORT: ESC R

CARRIAGE RETURNS DISPLAY AS: ESC G [S, F, 4, N]
S = space, F = full cell, 4 = dot 4, N = do not display

CTRL CHARACTERS OTHER THAN CARRIAGE RETURNS DISPLAY AS SPACES: ESC M [Y, N]

DUPLEX: ESC N [H, F]
H = Half, F = Full

FIND: ESC F string ESC E
(This command searches only in a forward direction.)

HANDSHAKE: ESC H [S, H, N]
S = software, H = hardware, N = no handshake.

INSERT: ESC I string ESC E

KEYBOARD LOCK: ESC K [Y, N]

LINEFEED APPEND IN TRANSMIT: ESC J [N, Y]

MOVE WINDOW TO NEXT DISPLAY: ESC +

MOVE WINDOW TO NEXT LINE: ESC >

MOVE WINDOW TO NEXT PARAGRAPH: ESC]

MOVE WINDOW TO END OF TEXT: ESC Z

MOVE WINDOW TO PREVIOUS DISPLAY: ESC -

MOVE WINDOW TO PREVIOUS LINE: ESC <

MOVE WINDOW TO PREVIOUS PARAGRAPH: ESC [

MOVE WINDOW TO BEGINNING OF TEXT: ESC A

SCREEN SELECT: ESC V [I, R, 8, 4]
I = IBM PC, R = Radio Shack Model 100, 8 = Apple computer with PRINT-IT! card (80 column mode), 4 = Apple computer with PRINT-IT! card (40 column left justified mode)]

TRANSMIT TEXT: ESC T [L, P, Z]
L = line, P = paragraph, Z = all from current window cursor location to end of text.

WINDOW OPTIONS: ESC W [C, Q, S, V, W]
C= Cell, Q = Read Columns, S = Scroll, V = Selected screen, W = Word

5.02 DEFAULT VALUES